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ABSTRACT

This four-volume student text is designed for use by Air Force personnel enrolled in a self-study extension course for dental assistant specialists. Covered in the individual volumes are an introduction to dental services (the mission and organization of medical/dental service, career ladder progressions, medical readiness/wartime training, and Air Force occupational safety and health); basic sciences (dental anatomy, physiology, and histology; oral pathology; dental materials; and dental therapeutics); administrative functions and chairside assisting (dental administration, publications and dental supply, dental instruments, housekeeping and equipment maintenance, professional standards and general assisting procedures, and specialty assisting procedures); and dental radiology and preventive dentistry). Each volume in the set contains a series of lessons, exercises at the end of each lesson, a bibliography, and answers to the exercises. Supplementary volume review exercises, series of foldouts, and a change supplement are also provided. (MN)

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ED268338

DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

EXTENSION COURSE INSTITUTE

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COURSE NUMBER	COURSE TITLE	EFFECTIVE DATE
98150	DENTAL ASSISTANT SPECIALIST (AFSC 98150)	6 Feb 85

INSTRUCTIONS *The following* ***materials are needed to complete this course. Check this list*** *immediately upon receiving your course package, and if any materials are missing or incorrect* ***(numbers don't match), notify ECI immediately.*** *Use the ECI Form 17 for this purpose, and be sure to include your identification number, address,* ***course and volume numbers, and*** *VRE* ***form designation*** *(if a VRE* ***is*** *involved). Send all correspondence separately from your answer sheet.*[1]

ITEM	TYPE	DESIGNATION OR TITLE	INVENTORY CONTROL NUMBER	VRE ANSWER SHEET IDENTIFICATION
1	ENV	ECI RETURN ENVELOPES (5 EACH)		
2		YOUR KEY TO A SUCCESSFUL COURSE	M-140	
3	VOL	VOL 1, Introduction to Dental Service	98150 01 8407	
4	VRE	VOLUME REVIEW EXERCISE (VOL 1)	98150 01 26	98150 01 26
5	VOL	VOL 2, Basic Sciences	98150 02 8407	
6	VRE	VOLUME REVIEW EXERCISES (VOL 2)	98150 02 25	98150 02 25
7	VOL	VOL 3, Administrative Functions and Chairside Assisting	98150 03 8408	
8	VRE	VOLUME REVIEW EXERCISE (VOL 3)	98150 03 25	98150 03 25
9	VOL	VOL 4, Dental Radiology and Preventive Dentistry	98150 04 8408	
10	VRE	VOLUME REVIEW EXERCISE (VOL 4)	98150 04 01	98150 04 01
11	SUPP	SUPPLEMENTARY MATERIAL (VOLs 2 and 3) (FOLDOUTS 1 through 19)	98150 00 S01 8408	
12	SUPP	CHANGE SUPPLEMENT (VOLs 1, 2, 3 and 4)	98150 00 S02 8410	
13	SUPP	SUPPLEMENTARY MATERIAL (FOLDOUTS 5 and 6)	98150 00 S03 8411	
14		ECI SURVEY	99-01	99-01
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[1] *SEE REVERSE SIDE FOR ADDITIONAL INSTRUCTIONS.*

ECI FORM JUN 84 25 **PREVIOUS EDITION WILL BE USED.**

Page 1 of 1

98150 00 S02 8410

CHANGE SUPPLEMENT

CDC 98150

DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

Volumes 1, 2, 3 and 4

IMPORTANT: Make the corrections indicated in this supplement before beginning study of Volumes 1, 2, 3 and 4. This supplement contains "pen-and-ink" changes and replacement pages. It is three-hole-punched and perforated so that you can tear out the replacement pages and insert them in your volumes. You are not required to post any changes listed in this supplement which correct typographical errors, unless such errors change or otherwise affect the meaning of the material.

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CHANGES FOR THE TEXT: VOLUME 1

Pen-and-Ink Changes:

Page-Col	Subject	Line(s)	Correction
1R		19 fr bot	Change "teeth" to "health."
2R		15 fr bot	Change "subprofessional" to "military" and after "or" add "civilian."
3L		2	Delete "travel with the patient and."
16R		20	Change "tank" to "task."
22L		6 fr bot	Delete "by."
28R		14	Change "reventive" to "preventive."

CHANGES FOR THE TEXT: VOLUME 2

Pen-and-Ink Changes:

Page–Col	Subject	Line(s)	Correction
1L		4-5	Change "we discuss anatomy, which is the study of the structure of" to "the living organism; physiology, which is the study of the structure and."
8R		6 fr bot	Change "1-4" to "1-6."
10R		13	Change "This" to "The."
		16	Delete "it."
		7 fr bot	Change "Trapeziius" to "Trapezius" and "trapezus" to "trapezius."
13L		21	Change "biceps" to "triceps."
18R		22-23 fr bot	Delete "The ejaculatory duct. The ejaculatory duct is formed by the."
30R		7	After "the" add "construction and dilation of the iris."
44R		11 fr bot	Change "hydro-ions" to "hydroxyl-ions."
53L		16 fr bot	Change "also" to "team."
54R		7	Change "10°0 C" to "100° C."
55R		8	Change "oftenal" to "canal."
		11 fr bot	After "Proceed with" add "caution."
57R		28	Delete "to to."
58L		15 fr bot	Change "these" to "These."
58R		4 fr bot	After "not" add "be."
62L	241-1.4		Delete the second "extended wings."
65L	242-8		Change "he" to "The."
81L		26	Change "pump" to "pulp."
	250-1.a.		Change "Nexk" to "Neck."
82L		5	Change "orizontal" to "Horizontal."

Page-Col	Subject	Line(s)	Correction
84L		4 fr bot	Delete "into."
84R		8 fr bot	Change "tooth'ss" to "tooth's."
85L		11 fr bot	Delete "what."
87R		last	Change "accoding" to "according."
92L		23 fr bot	After "over" add "the" and after "maxillary" delete "the."
93L		5 fr bot	Delete the second "sized."
93R		15	After "not" delete "is."
95L		6	Change "prophyloxis)" to "(prophylaxis)."
97L		6-7 fr bot	Change "you" to "the tooth" and "polish the teeth" to "is polished."
97R		4 fr bot	Delete "to."
102L		6 fr bot	Change "chroni" to "chronic."
103R		8	Before "tester" add "If a pulp."
107L		24	Change "that" to "may."
		26	After "position" add a comma.
107R		26 fr bot	After "This" add "is."
108L		29	Change "expels" to "expel."
109R		19	After "occlusion" add a comma.
110R		24 fr bot	Change "nystation" to "Nystatin."
		26 fr bot	Delete "of."
		27 fr bot	Change "imbalance. the" to "imbalance of the" and after "flora" add a period.
112R		28	Delete "to."
114R	272-1.f		Change "pat" to "part."
117L		7 fr bot	Change "frequent" to "appear.
118L		2	Change "Comingrom" to "Coming from."

Page-Col	Subject	Line(s)	Correction
118L		7	Delete the second "she."
		9 fr bot	Change "amterial" to "material."
119R		3 fr bot	Delete the second "to."
120L		18-19	Change "Heavy" to "A heavy", delete "is created" and change "it" to "the wire."
121R	278-8		Change "cuse" to "cause."
125L		11	Change "ready" to "needed."
126R		5	Change "not" to "now" and delete the second "is."
127R		23	Delete the second "closely."
131L		12	Delete the second "are."
131R	286-1(6)		Delete "A."
132L		23	Change "to support to support" to "under."
		34	After "is" add "the."
134L		12	Change "Onm" to "On."
		11-12 fr bot	Delete "you can complete", change "the" to "The" and after "set" add "occurs."
136L		18	Change "with" to "within."
137L		23-24	Change "Add a" to "A" and after "phosphate" add "is added."
139L		6 fr bot	After "obtain" add "from."
139R		4 fr bot	Change "hand tole" to "handle."
141R		5-6 fr bot	Delete "you use" and change "you will notice that" to "is used."
142L		16-17 fr bot	Delete "you can perform", change "rectal" to "Rectal" and after "medications" add "is accomplished."
142R	295-4		Delete the first "d." and change "e." to "d.", "f" to "e", and "g." to "f."

Page-Col	Subject	Line(s)	Correction
150L		14	Delete the second "to."
157L	235-18		Change "235-18" to "235-17" and before "Superficial" insert "235-18."
158L	250-1		Change answers to read "(1) c., (2) a., (3) b., (4) d., (5) e., (6) h., (7) i., (8) g., (9) j., (10) f., (11) j., (12) k., (13) b., and (14) g."
163	307-2		After "Fluorosis." add "307-3."

CHANGES FOR THE TEXT: VOLUME 3

Pen-and-Ink Changes:

Page-Col	Subject	Line(s)	Correction
19L		18 fr bot	Change "these" to "the" and before "603" insert "SF."
27R		8-9	Change "AF Form 994, Dental Laboratory Prescription and Consultation Request" to "DD Form 2322, Dental Laboratory Work Authorization."
		10-11	Change "AF Form 994, Dental Laboratory Prescription and Consultation Request" to "DD Form 2322, Dental Laboratory Work Authorization."
		21-22	Change "AF Form 994" to "DD Form 2322."
		28	Change "AF Form 994" to "DD Form 2322."
		33-34	Change "AF Form 994" to "DD Form 2322" and "precious" to "previous."
		16 fr bot	Change "AF Form 994" to "DD Form 2322."
		19-20 fr bot	Change "Prescription and Consultation Request, AF Form 994" to "Laboratory Work Authorization, DD Form 2322,."
28L	422-1(1)	14	Change "office" to "officer."
	422-1.a	1-3	Change "AF Form 994" to "DD Form 2322" and "Prescription and Consultation Request" to "Dental Laboratory Work Authorization."
28R	422-1(6)		Change "AF Form 994" to "DD Form 2322."
32L		1-16	Delete "Part 4, Reporting . . . in the report" and replace with "Part 4 Reserved."
32R	424-2.c		Delete.
33R		18	Change "any dental examinations" to " "the periodic dental examination."
		13 fr bot	After "sound" add "basis upon which."
38L	429-2,3,4		Chnage "FSN" to "NSN."

Page-Col	Subject	Line(s)	Correction
40R		23	Change "it" to "its."
41L	433-6		Change "officer" to "custodian."
42L		6 fr bot	Change "plan" to "plant."
43R		18	Delete "Base."
58L		21 fr bot	Change "notable" to "not able."
63L		6 fr bot	After "pulp," add "enlarging and."
64L		1-2	Delete "and" and "debridement."
66L		18	Change "to" to "so."
71R		24	After "air" add a comma.
76R		last	Change "70 percent isoprophyl alcohol" to "an approved disinfectant."
79L		1-2 fr bot	Change "a 70 percent solution of isopropyl alcohol" to "an approved disinfecting solution."
87R		12 fr bot	Change "after" to "often."
94R		11 fr bot	Change "a solution such as isoproyl alcohol" to "an approved disinfecting solution."
96L		9	After "assistant" add "to the."
98R		last	Change the second "you" to "your."
107L		25 fr bot	Change "will" to "may."
109R		11-13 fr bot	Change "AF Form 994, Dental Laboratory Prescription and Consultation Request" to "DD Form 2322, Dental Laboratory Work Authorization."
110L		10	Change "AF Forms 994 and 644" to "DD Form 2322 and AF Form 644."
		12	After "tray" delete ", is."
		16	After "usually" add "rubber base or."
		25	After "use" add "rubber base or."

Page–Col	Subject	Line(s)	Correction
110L		29	Change "AF Form 994" to "DD Form 2322."
		13-14 fr bot	Change "AF Form 994" to "DD Form 2322."
110R		3-4	Change "AF Form 994" to "DD Form 2322."
		16	Chnage "AF Form 994" to "DD Form 2322."
111R		5 and 17	Change "AF Forms 994 and 644" to "DD Form 2322 and AF Form 644."
		30	Change "AF Form 994" to "DD Form 2322."
112L		19 fr bot	Delete "or plastic."
114L		19 fr bot	After "aware" add "of other."
117L		17 fr bot	Change "ward" to "forward."
121R		22 fr bot	Change "is" to "may be."
124L		19	Change "same" to "some."
129R	405-5		Delete "and a polaroid color photograph are" and "The photograph must . . . entire occlusal aspect."
129R	406-1		Change "C." to "4."
	406-2		Change "B." to "2."
	406-3		Change "C." to "1."
137L	491-2		Change "AF Form 994" to "DD Form 2322."

Page Changes:

Remove Pages:	Insert Pages:
5-8	5-8
21-24	21-24b
131-132	131-132a

4. Subject to mission requirements, availability of space and facilities, and capabilities of the dental staff, what members of the uniformed services are authorized the same dental care as are active duty members?

5. Indicate in the blanks provided the correct order of priority for dental attendance at bases where family member dental care is authorized. (Some of the categories listed have the same priority.) Number your responses with number 1 being first priority.

_____ a. Retired members.
_____ b. Family members of active duty members.
_____ c. Family members of retired members.
_____ d. Active duty members.
_____ e. Family members of members who died while on active duty.
_____ f. Family members of members who died while on retired status.

6. Who must make the determination as to the availability of space and facilities and the capabilities of the dental staff to provide authorized family members dental care?

7. Subject to the availability of space, facilities, and staff capabilities, what diagnostic service is authorized for all dependents at all bases?

8. What generally limited care is provided to eligible civilian beneficiaries?

403. State procedures and forms used in the scheduling of patients.

Scheduling Patients. Once you know the patient's eligibility and the type of dental attendance to provide, you can schedule an appointment. As we said earlier, dental procedures vary from clinic to clinic; but there are similarities in handling appointments. Each clinic uses an appointment book and an appoint slip, and, in most cases, bases its systems on an incremental time period. Appointment schedules may be arranged to provide treatment of military and dependent personnel (when authorized) at different hours during the day, or even on different days of the week.

Sometimes it's necessary to arrange appointments by priority. The base dental surgeon determines the priority of dental appointments when manning or equipment are limited or short or when a person is going to a remote assignment and must have a dental clearance. You also need to be careful when scheduling appointments that you limit a patient's advance appointments. You want to keep a person's waiting time for a appointment to a reasonable length of time to minimize the number of broken appointments. This also leaves your clinic with enough time to handle any emergency cases.

Completing forms. Some clinics use AF Form 1223a, Dental Appointment Register, to keep a central appointment book at the reception desk. This form has an unnumbered hour and minute columns on both side and can be used to schedule appointments for eight operators for 1 day or one operator for 8 days. When you use AF Form 1223a, enter the patient's name under the operator's and the patient's organization designation under "unit." The advantages of a single appointment book is that it relieves the professional sections of appointment administrative duties and the clinic's professional sections don't have to answer calls about appointments. The book also provides a ready guide to let the receptionist draw the patient's records from the files before the day's appointments.

In some clinics, dentists use AF Form 1223, Dental Appointment Register, to keep their own appointment book. This system lets the dentists work out appointments to fit the patient's treatment needs.

When scheduling appointments in the appointment book make sure you do so accurately. Then, complete the patient's appointment slip. If you fail to do these two things and if you don't do them accurately, you could have more than one patient report for an appointment at the same time.

AF Form 490, Medical/Dental Appointment, is used for dental appointment slips. As an appointment is issued, record it on this form. You should fill out the form completely. Enter the person's name, grade, organization, date and time of the appointment, date issued, clinic to which the patient is to report, clinic phone number, and dentist with whom the appointment is made. Also, initial the form to verify the appointment. By doing all this, you provide a means of easily coordinating dental appointments with the individual's organization. You also benefit as a result of patients punctually meeting their scheduled appointments.

A policy can be adopted of reappointing patients to the same operator for all subsequent treatment of the same character. This policy is particularly applicable to restorative dentistry patients. On the other hand, a policy of reappointing patients to the next available open time may be preferable. Another alternate is to keep a few appointments open, thus permitting some flexibility in the dental officers schedule, allowing him or her to take care of unforeseen situations that may arise from time to time.

Broken appointments. Broken appointments result in a loss of man-hours for dental officers and technicians and should be kept to a minimum. You can help eliminate them by impressing upon patients the importance of keeping appointments. An active liaison between the Base Dental Service and the organizational units will also help minimize the problem.

Exercises (403):

1. What is common about all dental clinic appointment systems?

2. Who decides the priority of dental appointments when circumstances require a priority system?

3. What form is used by clinics to keep a central appointment book?

4. What form is used at clinics where each dentist keeps a personal appointment book?

5. What form is used for dental appointment slips?

1-2. Examination and Classification Standards

The dental examination is one of the basic professional services provided by the Air Force Dental Service. Soon after you entered the military service, you received your first dental-oral examination to determine your dental health. Throughout your service with the Air Force, you will receive periodic dental examinations. The results of these examinations are recorded on your individual dental health record. This record serves as a reference when you visit Dental Services.

404. State why the periodic dental examination is conducted; and cite action taken by the CBPO, the dental clinic, and organizational units in connection with this examination.

Periodic Examination Requirement. A periodic dental examination and a dental health record review are made to insure the currency of the dental health classification, to make early detection of dental-oral pathology, and to check the proper custody of the dental health record.

Consolidated base personnel offices (CBPOs) furnish the dental clinics with rosters of officers and airmen by their organizations and date of last examination. The CBPOs also furnish the organizational units with rosters and periodic dental examination notification cards. The dental clinic screens the dental health records and advises the organizational unit of the personnel who require a dental examination. The unit then coordinates the scheduling with the dental clinic, annotates the notification cards to advise members when to report for examinations, and sends the annotated cards to the members. A Type 2 examination is scheduled for personnel on the roster who have had less than a Type 2 or have had no dental examination in the past 3 months. If bitewing radiographs were taken during the past 12 months, a Type 3 examination may be substituted by the examining dentist. AFM 162-421, *Base Dental Service Reporting System,* and AFM 30-130, *Base Level Military Personnel System,* are the primary reference sources for managing and reporting the Periodic Dental Examination Program (PDEP). If you are involved in the PDEP, you need to be thoroughly familiar with these directives.

Exercises (404):

1. Give three reasons for conducting the periodic dental examination and dental health record review.

2. What actions does CBPO take before scheduling a periodic dental examination?

3. What steps do the dental clinic personnel then take following CBPOs action?

4. What three actions do organizational unit personnel take in regard to the periodic dental examination after they receive data from the CBPO and the dental clinic?

405. Identify the types of dental-oral examinations and clarify their use.

Dental-Oral Examinations. To insure uniformity in nomenclature and definitions, dental examinations are classified by type. The dentist has considerable latitude in deciding what examination to do, except where directives are specific. There are five types of dental examinations. Types 1, 2, 3, and 5 are recorded on the appropriate dental records. The Type 4 examination is a screening survey used to classify and not to record individual defects and abnormalities. The Type 5 screening examination is a modification of the Type 4 examination. A brief explanation of the five types of examination follows:

Type 1 examination (DOD Code 00140). This is the ideal examination, for it is the most comprehensive dental examination performed. It is an extensive examination of all hard and soft tissues, periodontal probing of all existing teeth, review of new or existing full-mouth intraoral periapical or panoramic radiographs with posterior bitewing radiographs, and formulation of a comprehensive treatment plan. The professional discretion of the examining dental officer and the availability of equipment dictate if new radiographs are required. When indicated, specialty consultations, other radiographs, diagnostic casts, transillumination, percussion, electrical or thermal tests, and other diagnostic procedures should be included. Because this examination is so comprehensive, it is not always practical to do it for all patients.

Type 2 examination (DOD Code 00120—periodic oral examination). This type is a routine examination and is the next most detailed examination. It is a mouth-mirror and explorer examination with adequate artificial lighting and posterior bitewing radiographs. When indicated, periapical radiographs are made. A periodontal screening examination is performed when the dental officer feels that it is needed.

Type 3 examination (DOD Code 00130—other examination). A Type 3 examination consists of a mouth-mirror and explorer examination, using either adequate natural or artificial lighting. This is a generalized examination of all hard and soft tissues. It includes emergency oral examinations for evaluation of pain, trauma, or defective restorations, the DOD-directed Preventive Dentistry Program for Children, and food handlers if requested. Selected area radiographs may be used.

Type 4 screening survey (DOD Code 00133—screening examination). The Type 4 examination consists of a mouth-mirror and explorer or tongue depressor examination with whatever illumination is available. It is most frequently used as a dental survey and to determine the need for oral hygiene instructions for personnel. The purpose of the screening, such as oral cancer screening, etc., is entered in the dental treatment record (SF 603).

Type 5 screening-entry into service (DOD Code 00133—screening examination). The Type 5 examination (used to initiate a member's dental record) consists of panoramic radiograph. When this type of examination is used by the military processing center, it must be followed by a Type 2 or Type 3 examination at the time the patient first receives either definitive treatment or a periodic dental examination.

Exercises (405):

1. Why are dental examinations classified by type?

2. What is the most comprehensive type of dental examination performed?

3. When is the periodontal screening examination performed as a part of the next most detailed type of examination (the routine Type 2 examination)?

4. What type of examination provides an excellent way of determining the need for oral hygiene instructions for the personnel of a base?

5. What does Type 5 screening—entry into service examination consists of?

406. Identify classifications used to indicate a patient's dental health.

Dental Classifications. The Air Force Dental Service has a uniform system for recording the results of a dental examination. It is a classification system that lets the operator determine the dental status of each individual and establish priorities of treatment. It keeps the base dental surgeon informed of the dental health status of the base. numbers are written to record the classification. Each classification is carefully determined in accordance with the prescribed criteria and is accurately recorded. A description of each classification follows:

Class 1. This classification is for those persons requiring no dental treatment.

Class 2. This classification is for those patients who have existing dental conditions which are unlikely to result in a dental emergency within 12 months.

Class 3. This classification is for patients who have existing dental conditions which are likely to cause a dental emergency within 12 months.

Class 4. This classification is for patients who require a dental examination.

Exercises (406):

Indicate the dental classifications that are written on the dental health record by writing 1, 2, 3, or 4 in the blank before each item below.

____1. This classification is for individuals who require a dental examination.

____2. This classification is for individuals whose existing dental condition is unlikely to result in a dental emergency within 12 months.

____3. This classification is for individuals who require no dental treatment.

1-3. Maintaining Dental Treatment Records

Everyone in the U. S. Air Force has a dental record. A dental record is a chronological record of examinations, evaluations, and treatment received during a member's military career. This record may serve as a means of treatment planning, for casualty identification, or as a basis for VA benefit claims after a member leaves the military service. In this section, we will cover the responsibility for dental records, the contents of the records, and the filing procedures. AFR 162-1, *Management and Administration of USAF Dental Activities*, presents the requirements in recording patient's diagnoses, authorized abbreviations, and teeth designations.

407. Specify individual responsibilities for the maintenance of dental health records.

Responsibility for Dental Records. While anyone who handles a patient's dental record is responsible for that record, there are some specific areas of responsibility within the dental clinic. In this section, we will cover the primary custodial responsibility, the general responsibility, and the contents of the dental records.

Primary custodial responsibility. The base dental surgeon is the primary custodian of the dental treatment records. This person is responsible for the preparation, maintenance, use, and protection of all dental health records. In some cases your office will have to handle the dental health records of Navy, Marine Corps, and Army active duty personnel. Treat them in the same manner as you would the records of Air Force active duty personnel. However, you may need to make some modifications so as to conform with appropriate Army and Navy regulations.

When it is not administratively feasible for the dental treatment facility to maintain custody of the dental treatment records, the base dental surgeon may recommend that they remain with the custodian of the unit personnel records group.

General responsibilities. Dental officers must see that treatment of facility's dental records include accurate and appropriate entries of all professional services given. To do this, they must know the regulations and directives governing the preparation of dental records. Because these records are used by various persons and agencies for professional and administrative purposes, uniform terminology is necessary. Other personnel, including the receptionist, appointment clerk, records clerk, and dental assistants and technicians, may be charged with making the entries and filing the records.

Exercises (407):

1. Speaking in general terms, who can we say is responsible for a dental health record.

2. Who is the primary custodian of the dental treatment records?

3. Who is responsible for the preparation, maintenance, or use of the dental treatment records?

4. When may the base dental surgeon allow dental treatment records to remain with the custodian of the unit personnel records group?

5. Who is responsible for seeing that dental records include accurate and appropriate entries of all professional services given?

408. Identify which items in a list of dental health record materials are permanent-type records and which are temporary.

Contents of the Treatment Record Folder. You'll find the data you need to provide a comprehensive treatment record of a patient's dental condition and treatments in the Treatment Record (AF Form 2100 series). This record folder has the permanent dental records for all categories of patients. Handle it with care. Don't mutilate it by doing any unauthorized taping or stapling.

Permanent records. The permanent records in the patient's Treatment Record folder are:

a. SF 603, Health Record-Dental, and SF 603A, Health Record-Dental-Continuation.

b. AF Form 696, Dental Patient Medical History.

c. AF Form 935, Periodontal Diagnosis and Treatment Plan.

d. Consultant and Laboratory reports and similar records.

e. Initial full mouth and panorex radiographs.

f. DD Form 2005, Privacy Act Statement-Health Care Records.

Temporary records. Temporary records are considered transitory documents. They have no specific professional value once the information that they contain is entered into the permanent record. These include:

a. Temporary SF 603, Health Record-Dental.

b. SF 513, Medical Record-Consultation Sheet, when it is used for treatment planning.

c. AF Form 644, Record of Dental Attendance.

Exercises (408):

1. What type of documents are temporary records considered to be?

9. What is entered in items 15 and 16 of SF 603A?

417. Identify correct statements about the function of AF Form 696, Dental Patient Medical History.

Dental Patient Medical History. The purpose of AF Form 696 is to identify any medical problems that could affect or contraindicate the dental treatment of a specific patient. Because a medical history must be worked up for all patients before a course of treatment can begin, have your patients or their sponsors to fill out AF Form 696, Dental Patient Medical History, in ink. This form will let the examining officer check the medical history of the patient and evaluate all positive entries and record any findings in the space provided. The examinating officer signs in ink all health histories initially evaluated. (See fig. 1-3.)

All histories with relevant positive entries are retained in the patient's dental folder. Histories that were completed 2 years before the date of the latest history should be destroyed if there are no positive entries or entry changes.

When the dental officer decides that entries on AF Form 696 reveal conditions that require special attention in the dental clinic, stamp "See History" under the patient's identification block on the right side of the front of the AF Form 2100 series record. The type face of the stamp should be no smaller than 5/16 inch and not obliterate other displays in that area of the folder.

Exercises (417):

Indicate whether each of the following statements is true or false by writing a T or an F in the blanks provided. Explain any false answers.

_____ 1. AF Form 696 provides the dental officer a method of checking the medical history of a patient and identifying any problem that could affect or contraindicate the patient's dental treatment.

_____ 2. In a case when a patient has some sensitivity, the entry SENSITIVITY is stamped or written in black ink immediately under the patient's name on the AF Form 2100 series.

_____ 3. Dental patient histories should remain in the dental folder for 2 years, regardless of whether the information obtained was positive or negative.

_____ 4. Only positive histories 2 years old should be destroyed.

418. State the purposes of AF Form 644, Record of Dental Attendance; and complete a sample AF Form 644 given hypothetical information.

Record of Dental Attendance. AF Form 644, Record of Dental Attendance, has several major functions. It provides information to be transposed to the dental health record and for compiling statistical data for the automated reports. In addition, the data in the periodic dental examination program section is used to update the base-level personnel system (BLPS), thus making this patient encounter form an integral part of patient management.

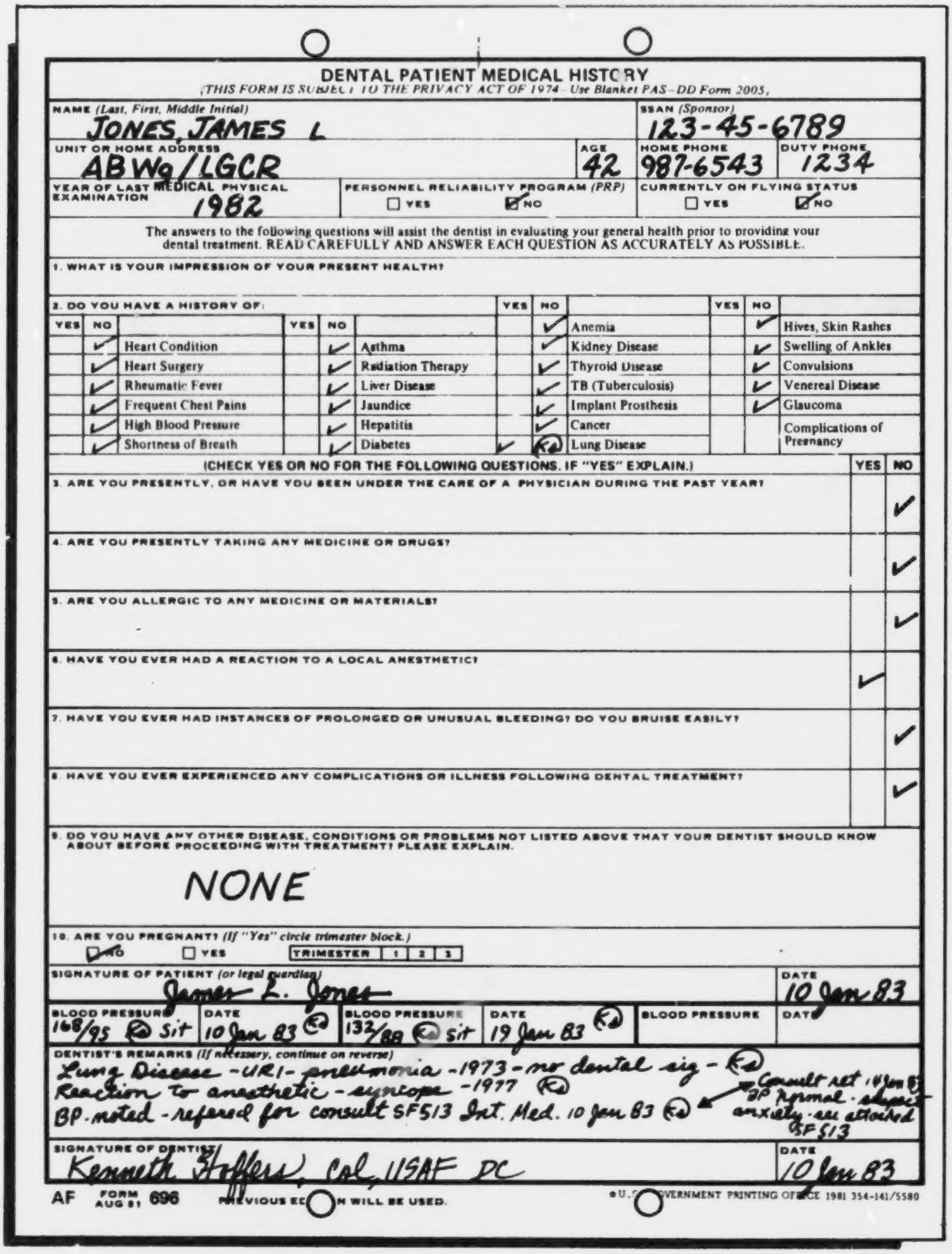
AF Form 644 is also used if:

(1) The dental treatment records are not available, such as when a person receives dental treatment away from the base where his or her record is filed. In this case a duplicate signed copy of AF Form 644 is sent back with the patient to be placed in his or her record. The base treating the patient takes credit for the treatment given. The base receiving the duplicate AF Form 644 updates the patient's record and makes sure that an appropriate BPLS card reaches the CBPO.

(2) A person receives treatment in one clinic and the record is on file in another clinic on the same base. In such cases, send AF Form 644 to the clinic maintaining the dental treatment records files.

(3) The dental treatment records remain with the field records group rather than in the facility and are not available at the time of attendance. Use AF Form 644 to record treatment. Transcribe data to SF 603 as soon as practical.

General Guidance. The dental technician or health care provider initiates an AF Form 644, or 644a. The records and reports section transfers information from AF Form 644 or 644a to the SF 603. All entries on these forms should be made legibly and in a contrasting color to decrease the possibility of overlooking or misreading information. AF Forms 644 and 644a should not be locally altered (for example, overprint, color variations, etc.) without prior authorization by HQ USAF/SGD. Each person examined or treated requires a form completed according to these instructions. Refer to figure 1-4 as we cover the instructions for completing AF Form 644.



DENTAL PATIENT MEDICAL HISTORY

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

NAME (Last, First, Middle Initial) JONES, JAMES L			SSAN (Sponsor) 123-45-6789	
UNIT OR HOME ADDRESS ABWg/LGCR		AGE 42	HOME PHONE 987-6543	DUTY PHONE 1234
YEAR OF LAST MEDICAL PHYSICAL EXAMINATION 1982	PERSONNEL RELIABILITY PROGRAM (PRP) ☐ YES ☑ NO		CURRENTLY ON FLYING STATUS ☐ YES ☑ NO	

The answers to the following questions will assist the dentist in evaluating your general health prior to providing your dental treatment. READ CAREFULLY AND ANSWER EACH QUESTION AS ACCURATELY AS POSSIBLE.

1. WHAT IS YOUR IMPRESSION OF YOUR PRESENT HEALTH?

2. DO YOU HAVE A HISTORY OF:

YES	NO		YES	NO		YES	NO		YES	NO	
							✓	Anemia		✓	Hives, Skin Rashes
	✓	Heart Condition		✓	Asthma		✓	Kidney Disease		✓	Swelling of Ankles
	✓	Heart Surgery		✓	Radiation Therapy		✓	Thyroid Disease		✓	Convulsions
	✓	Rheumatic Fever		✓	Liver Disease		✓	TB (Tuberculosis)		✓	Venereal Disease
	✓	Frequent Chest Pains		✓	Jaundice		✓	Implant Prosthesis		✓	Glaucoma
	✓	High Blood Pressure		✓	Hepatitis		✓	Cancer			Complications of Pregnancy
	✓	Shortness of Breath		✓	Diabetes	✓	Kd	Lung Disease			

(CHECK YES OR NO FOR THE FOLLOWING QUESTIONS. IF "YES" EXPLAIN.)	YES	NO
3. ARE YOU PRESENTLY, OR HAVE YOU BEEN UNDER THE CARE OF A PHYSICIAN DURING THE PAST YEAR?		✓
4. ARE YOU PRESENTLY TAKING ANY MEDICINE OR DRUGS?		✓
5. ARE YOU ALLERGIC TO ANY MEDICINE OR MATERIALS?		✓
6. HAVE YOU EVER HAD A REACTION TO A LOCAL ANESTHETIC?	✓	
7. HAVE YOU EVER HAD INSTANCES OF PROLONGED OR UNUSUAL BLEEDING? DO YOU BRUISE EASILY?		✓
8. HAVE YOU EVER EXPERIENCED ANY COMPLICATIONS OR ILLNESS FOLLOWING DENTAL TREATMENT?		✓

9. DO YOU HAVE ANY OTHER DISEASE, CONDITIONS OR PROBLEMS NOT LISTED ABOVE THAT YOUR DENTIST SHOULD KNOW ABOUT BEFORE PROCEEDING WITH TREATMENT? PLEASE EXPLAIN.

NONE

10. ARE YOU PREGNANT? (If "Yes" circle trimester block.)

☑ NO ☐ YES TRIMESTER | 1 | 2 | 3 |

SIGNATURE OF PATIENT (or legal guardian) James L. Jones					DATE 10 Jan 83
BLOOD PRESSURE 168/95 Kd Sit	DATE 10 Jan 83 Kd	BLOOD PRESSURE 132/88 Kd Sit	DATE 19 Jan 83 Kd	BLOOD PRESSURE	DATE

DENTIST'S REMARKS (If necessary, continue on reverse)

Lung Disease - URI - pneumonia - 1973 - no dental sig - Kd
Reaction to anesthetic - syncope - 1977 Kd
BP noted - refered for consult SF513 Int. Med. 10 Jan 83 Kd ↔ Consult ret 14 Jan 83 BP normal - ~~[illegible]~~ anxiety - see attached SF513

SIGNATURE OF DENTIST Kenneth Hoffers, Col, USAF DC	DATE 10 Jan 83

AF FORM AUG 81 696 PREVIOUS EDITION WILL BE USED. ★U.S. GOVERNMENT PRINTING OFFICE 1981 354-141/5580

Figure 1-3. Sample, AF Form 696.

Section I, Patient Information.

a. Name of Patient. Enter the patient's full name.

b. Grade. Enter the sponsor's grade.

c. Organization or Home Address. Enter the sponsor's organization or home address.

d. Date. Enter the date the services are rendered.

e. Time. Enter the time of day the services are rendered.

f. Name of Sponsor. Enter the sponsor's full name or "same" if patient is the sponsor.

g. Family Member Prefix (FMP). Reserved for later use.

h. Sponsor's Social Security Account Number (SSAN). Enter the sponsor's SSAN.

i. Beneficiary Type. Check the box that applies to the patient's beneficiary type.

j. Radiographic Prescription. Indicate the type and tooth number (when needed) for radiographic(s) ordered.

k. Transaction Type. Already completed.

l. Base Code. Enter the four-letter code for your base.

m. Clinic. Enter the proper number (1-9) for your clinic.

n. Supplement (SPLMNT). Enter a "2" if either of the following situations occurs; otherwise, leave blank:

(1) If more than nine procedure blocks are used.

(2) If more than two blocks have quantities of 10 or more.

o. Encounter Type. Enter the letter for the appropriate encounter (appointment) type (R, P, C, E, D, or A) that best describes the purpose of the patient's visit (see AFM 162-421, paragraph 3.2.1e(13)).

p. First FY Encounter. Reserved for later use.

q. Appointment Use. Reserved for later use.

r. Signature of Provider. Indicate review and acceptance of the accuracy and completeness of the AF Form 644 by having the provider sign here.

s. Grade. Enter the provider's grade.

t. Code. Reserved for later use.

Section II, Clinical Information. Write the treatment narrative which will be transcribed to the SF 603 in this area. Additionally, on the AF Form 644a, check the "PRP Notification Required" or "Notification Not Required" box. If action is necessary, bring it to the attention of the PRP monitor.

Section III, Dental Procedures and Services.

a. Make a check mark or put the numeric quantity of each procedure performed in the appropriate box.

b. Enter the code and quantity in "Other Procedures" at the bottom of the reverse side for procedures not having a box.

NOTE: All current guidelines and restrictions relating to procedure reporting will remain in effect, including the quantity limits per procedure.

PDEP Information (Active Duty AF Only). Complete each item on this line if there is a change in the patient's health status or if a periodic dental examination is performed.

a. First Two Letters Last Name. Self-explanatory.

b. Officer or Airman. Enter "O" for officer or "A" for airman.

c. Social Security Account Number (SSAN) Enter the patient's SSAN with the digits grouped by three, two, and four numbers.

d. Consolidated Base Personnel Office (CBPO). Enter the appropriate two-letter code for your CBPO.

e. Health Status. Enter the patient's dental classification.

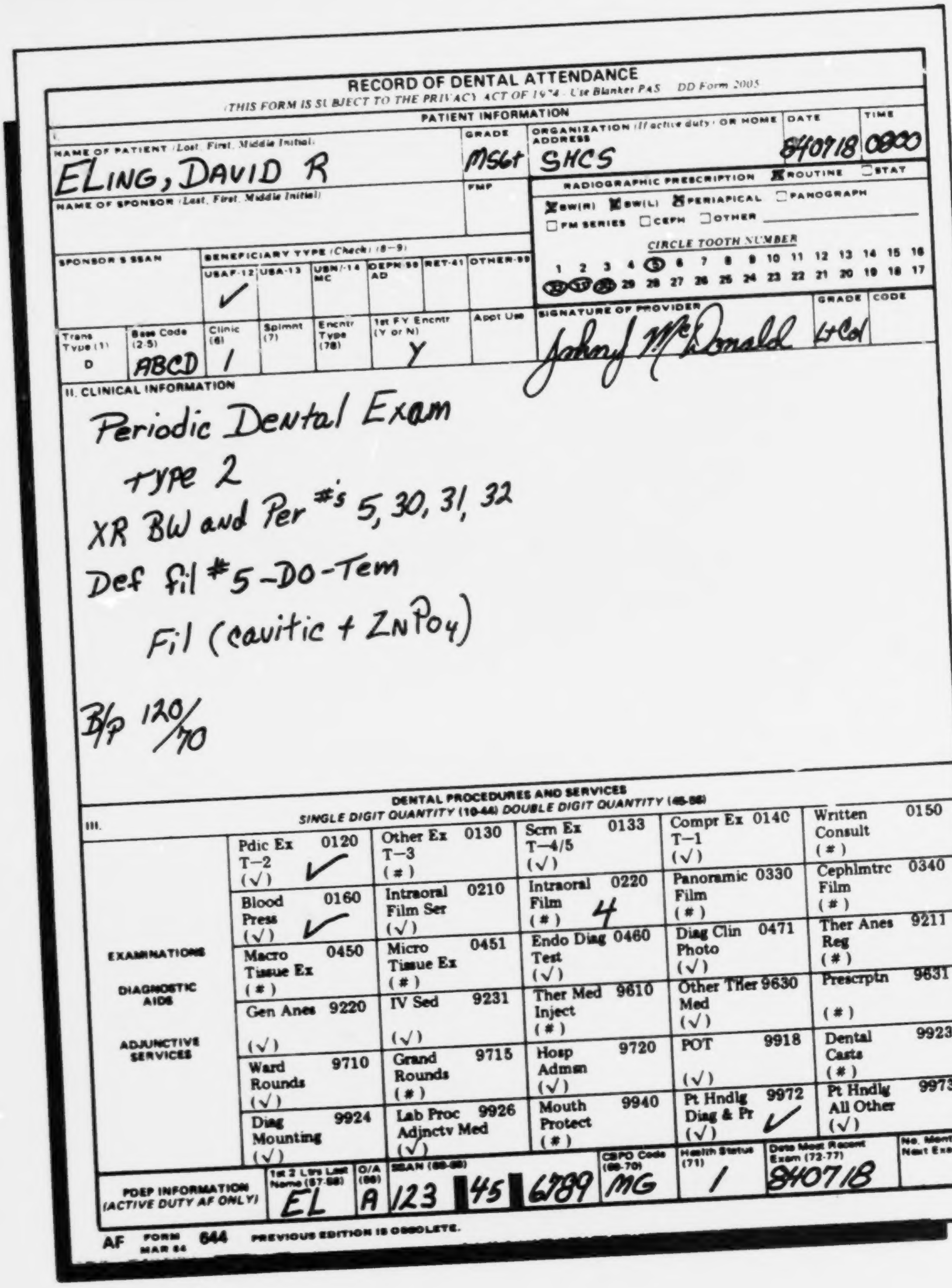
f. Date Most Recent Examination. Enter the date that the Type 1, 2, or 3 examination was done which caused the record to be updated.

g. Number of Months Next Examination. Reserved for later use.

Exercises (418):

1. Summarize the two major functions of AF Form 644.

2. Why is it imperative that you properly code and accurately record all entries on AF Form 644?



RECORD OF DENTAL ATTENDANCE
(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS DD Form 2005

PATIENT INFORMATION

I. NAME OF PATIENT (Last, First, Middle Initial) ELING, DAVID R	GRADE MSGT	ORGANIZATION (If active duty) OR HOME ADDRESS SHCS	DATE 840718	TIME 0800
NAME OF SPONSOR (Last, First, Middle Initial)	FMP	RADIOGRAPHIC PRESCRIPTION ☒ ROUTINE ☐ STAT ☒ BW(R) ☒ BW(L) ☒ PERIAPICAL ☐ PANOGRAPH ☐ FM SERIES ☐ CEPH ☐ OTHER ______		

CIRCLE TOOTH NUMBER

1 2 3 4 ⑤ 6 7 8 9 10 11 12 13 14 15 16
㉜ ㉛ ㉚ 29 28 27 26 25 24 23 22 21 20 19 18 17

SPONSOR'S SSAN	BENEFICIARY TYPE (Check) (8–9) USAF-12	USA-13	USN/-14 MC	DEPN-30 AD	RET-41	OTHER-99
	✓					

Trans Type (1)	Base Code (2-5)	Clinic (6)	Splmnt (7)	Encntr Type (78)	1st FY Encntr (Y or N)	Appt Use	SIGNATURE OF PROVIDER	GRADE	CODE
D	ABCD	1			Y		John J McDonald	LtCol	

II. CLINICAL INFORMATION

Periodic Dental Exam
type 2
XR BW and Per #'s 5, 30, 31, 32
Def fil #5-DO-Tem
Fil (cavitic + ZnPO4)

B/P 120/70

III. DENTAL PROCEDURES AND SERVICES
SINGLE DIGIT QUANTITY (10-44) DOUBLE DIGIT QUANTITY (45-56)

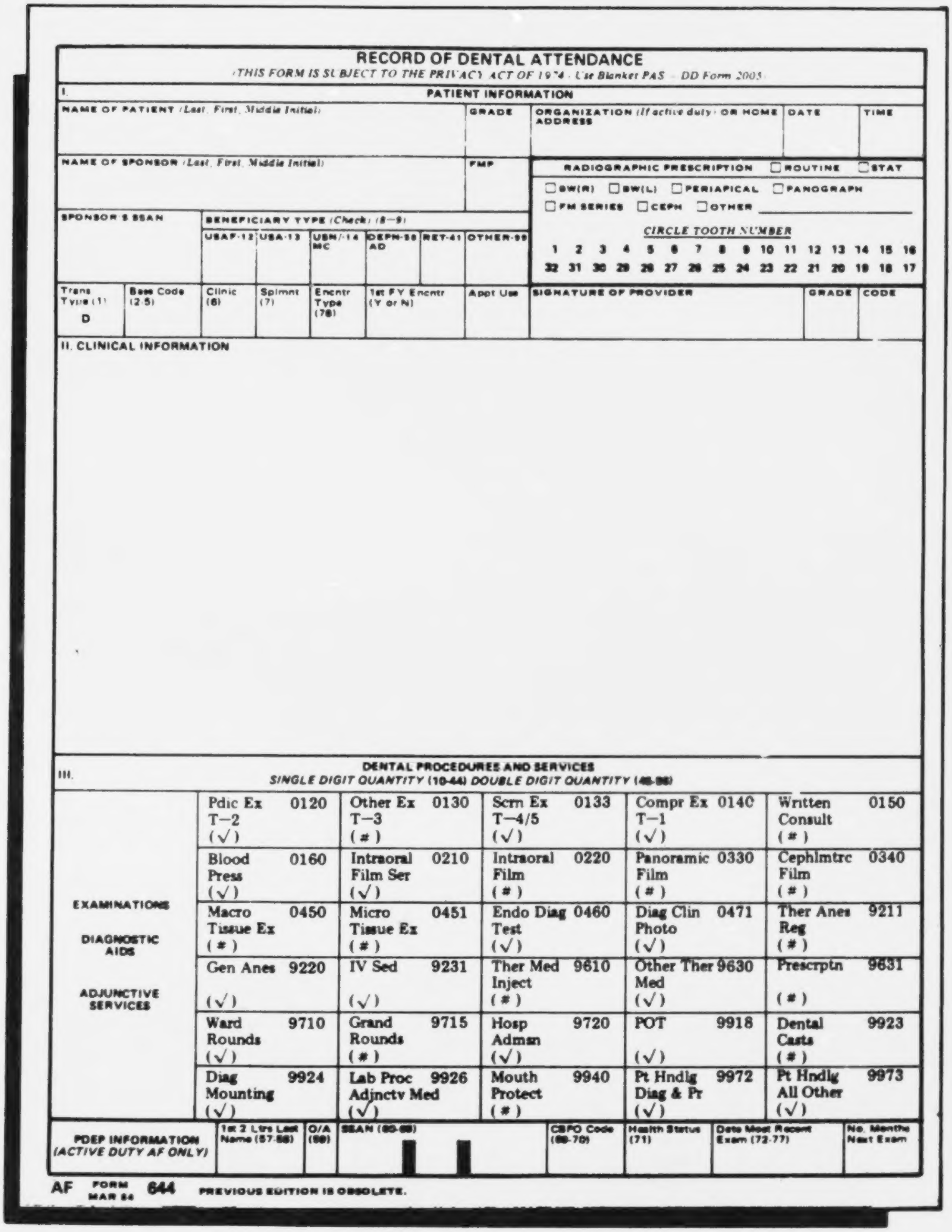
EXAMINATIONS
DIAGNOSTIC AIDS
ADJUNCTIVE SERVICES

Pdic Ex 0120 T–2 (√) ✓	Other Ex 0130 T–3 (#)	Scrn Ex 0133 T–4/5 (√)	Compr Ex 0140 T–1 (√)	Written Consult 0150 (#)
Blood Press 0160 (√) ✓	Intraoral Film Ser 0210 (√)	Intraoral Film 0220 (#) 4	Panoramic Film 0330 (#)	Cephlmtrc Film 0340 (#)
Macro Tissue Ex 0450 (#)	Micro Tissue Ex 0451 (#)	Endo Diag Test 0460 (√)	Diag Clin Photo 0471 (√)	Ther Anes Reg 9211 (#)
Gen Anes 9220 (√)	IV Sed 9231 (√)	Ther Med Inject 9610 (#)	Other Ther Med 9630 (√)	Prescrptn 9631 (#)
Ward Rounds 9710 (√)	Grand Rounds 9715 (#)	Hosp Admsn 9720 (√)	POT 9918 (√)	Dental Casts 9923 (#)
Diag Mounting 9924 (√)	Lab Proc Adjnctv Med 9926 (√)	Mouth Protect 9940 (#)	Pt Hndlg Diag & Pr 9972 (√) ✓	Pt Hndlg All Other 9973 (√)

PDEP INFORMATION (ACTIVE DUTY AF ONLY)	1st 2 Ltrs Last Name (57-58)	O/A (59)	SSAN (60-68)	CBPO Code (69-70)	Health Status (71)	Date Most Recent Exam (72-77)	No. Months Next Exam
	EL	A	123 45 6789	MG	1	840718	

AF FORM MAR 84 644 PREVIOUS EDITION IS OBSOLETE.

Figure 1-4. Sample AF Form 644.



RECORD OF DENTAL ATTENDANCE

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS — DD Form 2005)

I. PATIENT INFORMATION									
NAME OF PATIENT *(Last, First, Middle Initial)*						GRADE	ORGANIZATION *(If active duty)* OR HOME ADDRESS	DATE	TIME
NAME OF SPONSOR *(Last, First, Middle Initial)*						FMP	RADIOGRAPHIC PRESCRIPTION ☐ ROUTINE ☐ STAT ☐ BW(R) ☐ BW(L) ☐ PERIAPICAL ☐ PANOGRAPH ☐ FM SERIES ☐ CEPH ☐ OTHER ________ *CIRCLE TOOTH NUMBER* 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 32 31 30 29 26 27 28 25 24 23 22 21 20 19 18 17		
SPONSOR'S SSAN	BENEFICIARY TYPE *(Check) (8–9)*								
	USAF-12	USA-13	USN/-14 MC	DEPN-30 AD	RET-41	OTHER-99			
Trans Type (1) D	Base Code (2-5)	Clinic (6)	Splmnt (7)	Encntr Type (78)	1st FY Encntr (Y or N)	Appt Use	SIGNATURE OF PROVIDER	GRADE	CODE

II. CLINICAL INFORMATION

III. DENTAL PROCEDURES AND SERVICES

SINGLE DIGIT QUANTITY (10-44) DOUBLE DIGIT QUANTITY (45-56)

EXAMINATIONS DIAGNOSTIC AIDS ADJUNCTIVE SERVICES	Pdic Ex 0120 T—2 (√)	Other Ex 0130 T—3 (#)	Scrn Ex 0133 T—4/5 (√)	Compr Ex 0140 T—1 (√)	Written 0150 Consult (#)
	Blood 0160 Press (√)	Intraoral 0210 Film Ser (√)	Intraoral 0220 Film (#)	Panoramic 0330 Film (#)	Cephlmtrc 0340 Film (#)
	Macro 0450 Tissue Ex (#)	Micro 0451 Tissue Ex (#)	Endo Diag 0460 Test (√)	Diag Clin 0471 Photo (√)	Ther Anes 9211 Reg (#)
	Gen Anes 9220 (√)	IV Sed 9231 (√)	Ther Med 9610 Inject (#)	Other Ther 9630 Med (√)	Prescrptn 9631 (#)
	Ward 9710 Rounds (√)	Grand 9715 Rounds (#)	Hosp 9720 Admsn (√)	POT 9918 (√)	Dental 9923 Casts (#)
	Diag 9924 Mounting (√)	Lab Proc 9926 Adjnctv Med (√)	Mouth 9940 Protect (#)	Pt Hndlg 9972 Diag & Pr (√)	Pt Hndlg 9973 All Other (√)

PDEP INFORMATION *(ACTIVE DUTY AF ONLY)*	1st 2 Ltrs Last Name (57-58)	O/A (59)	SSAN (60-68)	CSPO Code (69-70)	Health Status (71)	Date Most Recent Exam (72-77)	No. Months Next Exam

AF FORM MAR 84 644 PREVIOUS EDITION IS OBSOLETE.

Figure 1-5. AF Form 644 (objective 418, exercise 3).

3. Using the information furnished below, plus the information contained in foldout 7, complete the AF Form 644 shown in figure 1-5.

The date is today's date. The patient is Chief Master Sergeant Michael L. T. Goodrich, USAF, SSAN 123-45-6789. Chief Goodrich is assigned to Regional Hospital Sheppard. The location designation of your facility is VNVP, and you are in the base's main dental clinic. A Type 2 examination, including bitewing radiographs, was performed. Chief Goodrich's blood pressure was 120/70. In addition to that examination, a mesio-occlusal carious lesion on the lower left second molar was repaired by placing a base material and an amalgam restoration. Chief Goodrich is in dental classification 2. The dentist was Dr. Kenneth Stoffers.

419. Given a series of statements about SF 513, Medical Record—Consultation Sheet, indicate which are true and which are false.

Medical Record—Consultation Sheet. To provide your patients with the best dental care possible, you need a thorough evaluation of their general and oral health. Careful and considerate charting of subsequent diseases requiring treatment is outlined in pencil on SF 603, Health Record—Dental, under item 16 (FO7) or on 603A, under the same item, with brief notes in the Remarks section underneath, when applicable. When a consultation is necessary within the dental service for treatment planning, SF 513, Medical Record—Consultation Sheet, is used (fig. 1-6). Operating instructions in dental clinics may provide an organized system of doing the treatment plan, indicating order of treatment by number. The system must be rational and applicable to all patients, incorporating recommendations of the various dental specialties into a final plan before definitive treatment is instituted. This approach may prevent later changes to the treatment plan. An orderly sequence in treatment planning would be as follows:

(1) Systemic phase. Indicate systemic conditions which require special management of the patient.

(2) Oral surgery phase. Indicate various oral surgical procedures and identify the teeth to be removed. (Indicate a preoperative dental prophylaxis, if necessary.)

(3) Soft tissue phase. Indicate periodontal therapy for the elimination of gingival inflammation and periodontal pockets and the establishment of physiologic gingival contour.

(4) Functional phase. Indicate occlusal equilibration, restorative dentistry, and fixed and removable prostheses to establish an optimum relationship for the entire dentition (Indicate orthodontic therapy when it is the treatment of choice and is available.)

(5) Maintenance phase. Indicate instructions for preventive dentistry counseling, periodic recall for special evaluation of the patient, and continuous provision of followup treatment, as required.

File treatment plans accomplished on SF 513 in the dental treatment record folder. They may be removed when the proposed treatment has been completed, or they may be modified to reflect current treatment needs.

416 – 7. Subsection 15, Restorations and Treatments; Subsection 16, Subsequent Diseases and Abnormalities; and Subsection 17, Services Rendered.

416 – 8. Subsection 17, Services Rendered.

416 – 9. Subsection 15, Record only treatment rendered or indicated in Section 17 of SF 603a.

417 – 1. T.

417 – 2. T.

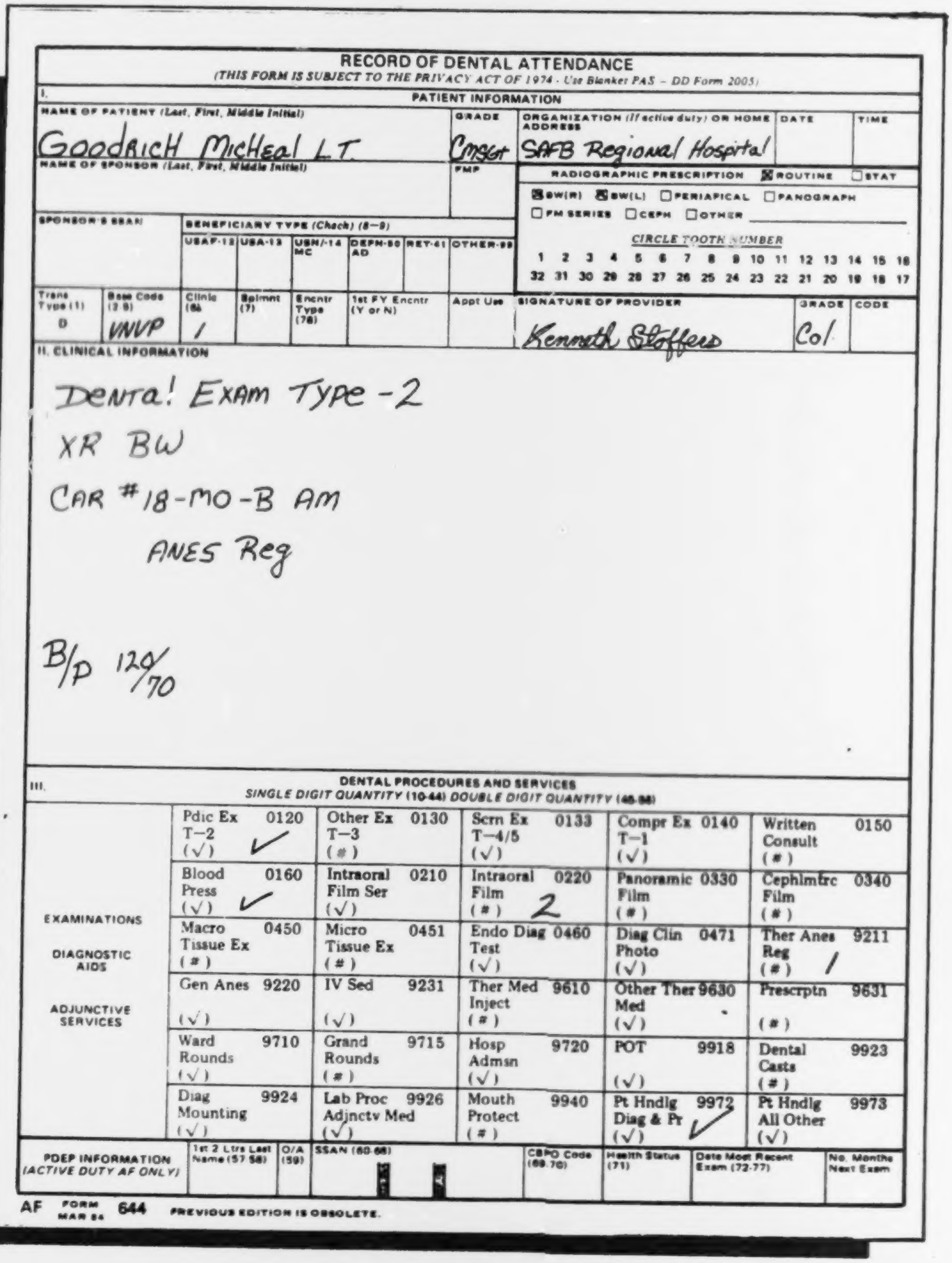
417 – 3. T.

417 – 4. F. All histories with relevant positive entries are retained in the patients dental folder.

418 – 1. To provide the information necessary for maintaining patient's individual dental health records and (2) to provide statistical data for the dental service report, thereby informing higher headquarters of the dental procedures performed by your clinic.

418 – 2. Because AF Form 644 provides information for keypunching.

418 – 3.



RECORD OF DENTAL ATTENDANCE

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS – DD Form 2005)

I. PATIENT INFORMATION

NAME OF PATIENT *(Last, First, Middle Initial)* Goodrich Micheal L.T.	GRADE CMSGT	ORGANIZATION *(If active duty)* OR HOME ADDRESS SAFB Regional Hospital	DATE	TIME

NAME OF SPONSOR *(Last, First, Middle Initial)*	FMP	RADIOGRAPHIC PRESCRIPTION ☒ ROUTINE ☐ STAT

☒ BW(R) ☒ BW(L) ☐ PERIAPICAL ☐ PANOGRAPH

☐ FM SERIES ☐ CEPH ☐ OTHER

CIRCLE TOOTH NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

SPONSOR'S SSAN

BENEFICIARY TYPE *(Check)* (8–9)

USAF-12	USA-13	USN/-14 MC	DEPN-50 AD	RET-41	OTHER-99

Trans Type (1)	Base Code (2-5)	Clinic (6)	Splmnt (7)	Encntr Type (78)	1st FY Encntr (Y or N)	Appt Use	SIGNATURE OF PROVIDER	GRADE	CODE
D	VNVP	/					Kenneth Stoffers	Col	

II. CLINICAL INFORMATION

Dental Exam Type -2

XR BW

CAR #18-MO-B AM

ANES Reg

B/P 120/70

III. DENTAL PROCEDURES AND SERVICES

SINGLE DIGIT QUANTITY (10-44) DOUBLE DIGIT QUANTITY (45-88)

EXAMINATIONS DIAGNOSTIC AIDS ADJUNCTIVE SERVICES	Pdic Ex 0120 T–2 (√) ✓	Other Ex 0130 T–3 (#)	Scrn Ex 0133 T–4/5 (√)	Compr Ex 0140 T–1 (√)	Written 0150 Consult (#)
	Blood 0160 Press (√) ✓	Intraoral 0210 Film Ser (√)	Intraoral 0220 Film (#) 2	Panoramic 0330 Film (#)	Cephlmtrc 0340 Film (#)
	Macro 0450 Tissue Ex (#)	Micro 0451 Tissue Ex (#)	Endo Diag 0460 Test (√)	Diag Clin 0471 Photo (√)	Ther Anes 9211 Reg (#) /
	Gen Anes 9220 (√)	IV Sed 9231 (√)	Ther Med 9610 Inject (#)	Other Ther 9630 Med (√)	Prescrptn 9631 (#)
	Ward 9710 Rounds (√)	Grand 9715 Rounds (#)	Hosp 9720 Admsn (√)	POT 9918 (√)	Dental 9923 Casts (#)
	Diag 9924 Mounting (√)	Lab Proc 9926 Adjnctv Med (√)	Mouth 9940 Protect (#)	Pt Hndlg 9972 Diag & Pr (√) ✓	Pt Hndlg 9973 All Other (√)

PDEP INFORMATION *(ACTIVE DUTY AF ONLY)*	1st 2 Ltrs Last Name (57-58)	O/A (59)	SSAN (60-68)	CBPO Code (69-70)	Health Status (71)	Date Most Recent Exam (72-77)	No. Months Next Exam
			[redacted] [redacted]				

AF FORM MAR 84 644 PREVIOUS EDITION IS OBSOLETE.

Figure A–2. Sample, AF Form 644, Record of Dental Attendance objective 418, exercise 3).

419 - 1. T.
419 - 2. F. The system must be rational and applicable to all patients incorporating recommendations of the various dental specialties into a final plan before definitive treatment is instituted.
419 - 3. F. The oral surgery phase should be placed before the soft tissue phase.
419 - 4. T.
419 - 5. T.
419 - 6. F. Only general information and avoidance of dental abbreviations.

420 - 1. It provides a basic periodontal examination, diagnosis and treatment planning record for periodontal therapy.
420 - 2. It becomes a permanent part of the patients dental record.
420 - 3. The patients periodontal status before, during, and after active periodontal therapy.
420 - 4. AFR 162-1.

421 - 1. T.
421 - 2. F. It is used to request X-ray examinations other than dental X-ray services.

422 - 1. (1) c.
(2) d.
(3) d.
(4) a.
(5) a.
(6) b.

423 - 1. Standard Form 88, Report of Medical Examination, and Standard Form 521, Clinical Record—Dental.
423 - 2. The purpose of the medical physical will already have been noted on the SF 88 initiated by the hospital; from this purpose, the type of dental examination is determined.
423 - 3. No. It is a part of the hospital records maintained for the patient; however, the dental treatment record on it should be summarized and the summary should be entered on the dental health record.
423 - 4. So that any dental care provided does not interfere with the patient's medical treatment.

424 - 1. It helps to keep Dental Services strength at the proper level, evaluate the effect of, or the need for, improvements in the organization, procedures, methods, equipment, training, and professional education in the clinic. The report also supports current personnel staffing, forecast requirements pertaining to professional care, manpower, equipment, facilities, and training.
424 - 2. a. Part 1 contains the total dental procedures and services provided to patients by dental care providers. The input data depicts the full health care delivery of a dental activity. Dental managers use this report for budgeting and operations planning. AFM 162-693 covers procedures for completing this part of the dental service report.
b. Part 2 summarizes the professional capabilities, availability and management of dental personnel resources. It identifies all key personnel, officers, enlisted and civilians assigned to the clinic. Also laboratory technicians with special experience identifiers, the number of cases mailed to area dental laboratorys, Red Cross volunteers mandays, and time utilization of military and civilian employees.
c. Deleted.

d. Part 5 is submitted by all dental personnel on extended active duty who attend a training course in a civilian or military institution.
e. Part 6 provides information requirements and normally covers the entire course length. Long courses are submitted quarterly.

425 - 1. The budget sets the final pattern for the financial operation of a clinic for an entire year.
425 - 2. The age and condition of the equipment must be known. In order to determine if a replacement or new item is to be requested.
425 - 3. The dental service's Medical Expense Report, RSC: HAF-SGD (Q) 7104.

426 - 1. To publish objective, comprehensive, and accurate accounts of Air Force activities.
426 - 2. The Office of the Surgeon General.
426 - 3. The significant developments in military medicine and their contributions to operational effectiveness.
426 - 4. It is incorporated in the history of the medical unit.

427 - 1. (1) c.
(2) d.
(3) b.
(4) a.

CHAPTER 2

428 - 1. (1) a.
(2) b.
428 - 2. AFR 0-2.
428 - 3. A regulation.
428 - 4. That this is the first departmental regulation that has been issued for this subject series.
428 - 5. AFR 0-9.
428 - 6. Local reproduction authorized.
428 - 7. That the information has changed or a new form has been issued since the last edition of the index.
428 - 8. Consult the last section of AFR 0-9 to learn what you should do with the obsolete forms on hand.

429 - 1. Expendable items are those items for which all accountability is dropped from the records when they are issued. Nonexpendable items are those items that retain their identity throughout the period of their use and for which accountability must be maintained on official records.
429 - 2. The group.
429 - 3. The class.
429 - 4. Specific items in the group.
429 - 5. (1) c.
(2) f.
(3) a.
(4) g.
(5) d.
(6) e.
(7) b.

430 - 1. T.
430 - 2. F. You are responsible for keeping your Federal Supply Catalog.
430 - 3. T.
430 - 4. T.

431 - 1. The table of allowances (TAs).
431 - 2. To tell what each clinic may procure in order to perform its mission.
431 - 3. TA 891, Dental Clinic, and TA 892, Dental Laboratory.
431 - 4. The number of people the clinic serves.
431 - 5. A working level that normally does not exceed a 2-week supply.
431 - 6. The base medical supply activity.

432 - 1. Each supply item has a maximum level and reorder point. When the shelf supply reaches the reorder point, you order the quantity needed to bring the shelf supply back up to the maximum level.
432 - 2. The base medical supply officer.
432 - 3. Because any items listed on the issue document will be charged against your account, whether you receive them or not.
432 - 4. In stock number sequence.
432 - 5. Local policies.
432 - 6. The medical supply officer.
432 - 7. MEMO.
432 - 8. To reveal whether or not (1) items and quantities on hand are adequate, (2) items on hand are fit for use, and (3) established levels are realistic.
432 - 9. Annually, or more often if this is considered necessary by the base dental surgeon, the medical supply officer, or higher authority.
432 - 10. Narcotics and alcohol must be inventoried at least monthly, and items such as precious metals must be inventoried at least quarterly.

432 – 11. A disinterested officer, or an NCO in the top three grades who has been appointed by the director of Base Medical Services.

432 – 12. Medical Supply.

433 – 1. Every Air Force member.

433 – 2. It is in no way lessened.

433 – 3. Personnel who have property responsibility must pay for the loss, damage, or destruction of property resulting from their maladministration or negligence in the use, care, custody, or safeguarding of such property from causes other than fair wear and tear.

433 – 4. The finder.

433 – 5. Property may be turned in to Base Supply as excess; it may be transferred from one organization or person to another; or, in the case of damaged or lost items, the person who has custody may be liable and may be required to pay for them.

433 – 6. A written record of the transfer of the property responsibility must be made.

434 – 1. (1) d.
(2) a.
(3) c.
(4) b.

434 – 2. The appointing authority and the investigating officer.

434 – 3. The person responsible for the custody of the property in question may or may not be required to pay for it.

435 – 1. The medical equipment maintenance section.

435 – 2. Medical Supply may schedule repair by a civilian firm, send the equipment to a base having repair facilities, or schedule a visit by a medical equipment repairer from your support base.

435 – 3. The base civil engineering group.

435 – 4. Minor emergency repairs.

435 – 5. A work order request must be submitted by the hospital engineer.

CHAPTER 3

436 – 1. Handle, shank, and working end.

CHANGES FOR THE TEXT: VOLUME 4

Pen-and-Ink Changes:

Page-Col	Subject	Line(s)	Correction
1L		22 fr bot	After "mirror" add "and."
28R		2 fr bot	Change "if" to "of" and after "determine" add "if it."
		4 fr bot	Delete "p.5."
29R		10	Change "functions" to "functioned."
30L		4	Change "Because" to "Initially because."
31L		16 fr bot	After "This" add "gets."
31R		23 fr bot	Change "examines" to "has" and after "handlers" add "examined."
33L		12 fr bot	Change "carefully edited by your" to "approved by your preventative dentistry officer and the."
39R		11 fr bot	Change "should" to "may need to."
40L		2	Change "veins" to "vessels."
46R		5 fr bot	After "calculus." add "First always check any current radiographs."
52R	636-3		Delete.
53L		24	Delete "topical."
		25	After "paste" add "and does not replace the topical application of 8 percent treatment."
56L		13	After "and" add "mechanically mix or."
63L		23 fr bot	Change "mouth " to "oral."
68R		23	Change "styalin" to "ptyalin."
79L		19 fr bot	Change "his" to "This."
110R		23	Change "indicae possivle" to "indicate possible."

Page-Col	Subject	Line(s)	Correction
110R		32	Change "hyypoglycemic" to "hypoglycemic."
111L		1	Change "Treatment protects" to "Treatment is to protect."
117L	636-3		Delete.

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CDC 98150

DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

Volume 1

Introduction to Dental Service

Extension Course Institute
Air University

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Preface

YOUR 98130 AFSC indicates that you are an apprentice dental specialist. Apprentice means learner or novice and this adequately describes your status in training. This Career Development Course (CDC) will provide you with the information needed, if studied, to upgrade you to AFSC 98150. The information you learned in the basic Dental Assistant Course can now be used as a stepping stone to new levels of knowledge.

This CDC is developed in four volumes with each volume supporting the following volume. For example, information found in Volume 1 is referred to in succeeding volumes without explanation because it is assumed that you have already learned the information.

Volume 1 addresses subjects that are basic background information of dental/medical personnel. Some of this information is not used in the daily work situation but is needed to ensure a well rounded medical education. This volume provides historical and mission information, plus a brief introduction to medical and dental relationships. Volume 2 builds on already existing basic science knowledge and covers factors pertaining to dental materials. Volume 3 stresses fundamental administrative, general, and specialty assisting procedures. Volume 4 addresses dental radiology, preventive dentistry techniques, and management of medical emergency procedures in a clinic.

Code numbers appearing on figures are for preparing agency identification only.

NOTE: If you know this course contains erroneous or outdated information or does not provide the knowledge that the current Specialty Training Standard (STS) requires you to have for upgrade training, contact your unit OJT advisor and fill out AF Form 1284, Training Quality Report. If you need an *immediate* response to subject matter questions while you are studying this course, call the author between 0700 and 1600 (CST) Monday through Friday.

Consult your education officer, training officer, or NCO if you have questions on course enrollment or administration, Your Key to a Successful Course, and irregularities (possible scoring errors, printing errors, etc.) on the Volume Review Exercises and Course Examination. Send questions these people can't answer to ECI, Gunter AFS AL 36118, on ECI Form 17, Student Request for Assistance.

(NOTE: *Do not use the Suggestion Program to submit corrections for printing* or typographical errors.)

This volume is valued at 15 hours (5 points).

Material in this volume is technically accurate, adequate, and current as of March 1984.

Contents

Page

Preface iii

Chapter

1 Mission and Organization of Medical/Dental Service 1

2 Career Ladder Progression 10

3 Medical Readiness/Wartime Training 15

4 Air Force Occupational Safety and Health 35

Bibliography 44

Answers for Exercises 45

NOTE: This course teaches through numbered lesson segments, each containing a behavioral objective, text, and exercises. The objective sets your learning goal. The text gives you the information you need to reach that goal, and the exercises let you check your achievement. When you complete each segment, see whether your answers match those in the back of the volume. If your response to an exercise is incorrect, review the objective and its text.

CHAPTER 1

Mission and Organization of Medical/Dental Service

CONSIDER YOURSELF fortunate to be in the Dental Career Field. Not only is dentistry an honored profession in civilian life, but it performs a vital function in support of primary Air Force missions. The 1980s is an exciting time to be associated with dentistry because the newest clinical advances and dental preventive programs have the potential for eradicating dental disease in the foreseeable future. There has been improvement in the nature of dental treatment, the utilization of fluorides has increased, dental care has become more available, and the principles of prevention have become more generally understood.

Your role as a dental specialist is essential to the success of all Air Force missions. To fulfill your role, you have a built-in requirement to perform as a member of the "dental health team." This team consists of you and the dental officer. This role makes you directly responsible for many provider tasks during patient treatment. In carrying out your dental health team responsibilities, you must relate to various dental patients. You have the opportunity to meet new people from all walks of life. By practicing good human relations, you gain new friends, realize greater job satisfaction, and aid in mission accomplishment. In this way you are performing in a necessary and rewarding career field.

We begin this phase of your career development training by looking at the mission and organization of the Medical Service as it is laid down by Air Force regulations (AFRs) and supporting Air Force manuals (AFMs).

1-1. The Air Force Medical/Dental Mission

Your job as a dental assistant is an important part of the dental mission which in turn is a part of the overall medical mission. The medical mission supports the Air Force mission that supports policies established by the President and Congress. To gain a better understanding of the medical/dental mission let's define mission and look at some specifics of medical, professional, and administrative services.

001. State the Air Force Medical Mission.

The Medical Service. The mission of the Air Force Medical Service is "... to provide medical support necessary to maintain the highest degree of combat readiness and effectiveness of the Air Force."

As a dental specialist you must always remember that you are a medic assigned to a hospital. The hospital is comprised of different sections including internal medicine, mental health, pharmacy, radiology, dental, and others, all working as a unit to fulfill the medical mission. Each section has a defined mission. By each section fulfilling its own mission requirements, it supports the overall medical mission.

Exercises (001):

1. What is the mission of the Air Force Medical Service?

2. What is your first job even if you are a dental airman?

002. State the Air Force Dental Service mission and indicate how the mission is supported by sections within the dental service.

Mission Defined. The mission of the Air Force Dental Service reads: "Maintain the oral teeth of the Air Force personnel and other uniformed service members to ensure their maximum wartime readiness and combat capability. Train to ensure competency in tasks required to support the overall medical mission in time of war or other contingency situations. Provide, to the greatest extent possible, a peacetime oral health service for all eligible beneficiaries."

You as a dental assistant support the medical mission when you perform your ordinary dental duties. You may also be called upon to participate as a W90230 augmentee. WARSKIL training teaches you basic medical tasks enabling you to function in the role of a W90230, Medical Service Specialist augmentee. During a period of armed conflict with an enemy force, the need may arise to provide battlefield support for the casualties. Under such circumstances, the 902X0 staff is mobilized and moved to areas to provide medical support for the casualties. To fill the voids left by the mobilized 902X0, those who hold the W90230 Air Force Specialty Code (AFSC) are activated and placed on duty within the scope of their W90230 AFSC.

As you can see, you have a lot of responsibility not only as a member of the dental team but also as a medic. You are not alone in supporting the mission. Support elements of the professional and administrative services of the dental clinic all work together to accomplish the mission. Let's briefly look at these support elements.

Professional Services. Sections within the dental clinic actively involved in patient care are considered to be professional services. The support sections that comprise the professional services are discussed briefly below. Many of these sections are discussed in more detail later in Volume 3 of this CDC.

Examination section. Dental examinations constitute one of the basic professional services provided by the Air Force Dental Service. The examination section identifies patients needing dental treatment by detecting and recording abnormal oral conditions. Patients are then properly routed to the appropriate treatment sections for care. In some cases, the patient is referred to another treatment facility for treatment if the prescribed treatment is beyond the capabilities of the clinic.

Restorative section. Restorative dental treatment encompasses a major part of the Air Force dental professional care. In essence, it is the treatment rendered to restore a patient's dental condition to a healthy, functional, and esthetically (pleasing to the eye) acceptable level. The restorative section is primarily responsible for the restoration of decayed or fractured teeth. Restorative dentistry is essential to prevent and reduce manpower losses due to dental conditions.

Speciality sections. Included in the specialty sections are oral surgery, prosthodontics, periodontics, endodontics, orthodontics, and pedodontics. Each of these sections has its own specific role in the support of the dental mission. The specialities provide treatment for those conditions that cannot be treated by the restorative section. If specialty treatment is needed but not available, patients may be referred to another base that has the capability.

Preventive dentistry section. The Air Force places great emphasis on the prevention of oral diseases. To reduce the incidence of dental disease, the Air Force has established the USAF Preventive Dentistry Program. Broadly stated, the goals are to prevent oral disease and maintain high standards of oral health. To accomplish these goals, the USAF Dental Service has divided the program into three phases—the clinical phase, community health phase, and dependent children's phase. The preventive dentistry section is covered in detail in Volume 4 of this CDC.

Radiographic section. The radiographic section supports the other sections by providing necessary diagnostic radiographs. These radiographs are used in all sections of the dental clinic as aids for dental treatment.

Administrative Services. Basically speaking, the administrative services perform various functions needed to support the professional services. Included in the responsibilities of the administrative services are the management of the dental facility, provision of operational supplies, training of personnel, preparation and submission of reports, scheduling and reception of patients, and maintenance of patient records.

Management. While the dental officers are under the direct supervision of the base dental surgeon or his or her designated representative, you are supervised by the dental superintendent, or NCOIC, or their designated representative. The dental superintendent or the NCOIC is usually a senior NCO having many years of experience in the dental field. He or she assigns you to a work area, makes arrangements for your training, and evaluates your progress at periodic intervals. The superintendent or NCOIC works closely with the base dental surgeon in the overall management of the dental clinic. In addition to his or her supervisory function, the superintendent or NCOIC is also responsible for the unit administration of the dental clinic. Unit administration tasks include preparing necessary duty rosters and reports for the base dental surgeon. These reports may be those of internal interest or those to be forwarded to higher headquarters.

Dental supply. As surely as a train needs tracks, a dental clinic needs supplies to operate. Providing these supplies is another function under the administrative services. Supplies must be ordered, stocked, and issued if the professional service is to have the items it needs to treat patients. Additionally, the supply section must budget for the supplies and any new or replacement equipment.

Training. As you are probably well aware, the adequate training of personnel is a must if the mission is to be accomplished. Most of your training is provided through this CDC and through OJT within the clinic. Although a great portion of this training is provided in the professional service areas, it must be scheduled and documented by the administrative section.

Records/reception. The records and reception section of the dental clinic provides three basic services. These services are patient reception, appointment scheduling, and health record maintenance.

Patient reception. The first step in patient reception is to greet him or her in a pleasant manner. Next, verify the patient's eligibility for treatment and complete or locate the necessary patient treatment forms and records. Finally, direct the patient to the appropriate waiting or treatment area and distribute the forms and records. The exact procedures and their sequence may vary from clinic to clinic. It is important to note, however, that these administrative duties are carried out by subprofessional or clerical personnel so that the dental officer may devote his or her time to professional patient care.

Appointment scheduling. With a limited number of dental officers available and only so many hours that they can work, patients must be scheduled for treatment by appointment. If there were no appointment system, patients just sitting in the waiting room awaiting treatment would result in the loss of a lot of duty time. Therefore, the appointment system is an aid to all organizations, allowing them to better manage their manpower.

Records maintenance. In their way, dental records can be as important to a patient as his or her pay record. Dental records are important in providing a chronological record of dental treatment that each patient has received and as a possible source of information for identifying deceased personnel. These records travel with the patient and are used as a reference each time the person appears in a dental clinic. Generally, the records are maintained in the clinic as long as the person to whom they apply remains at that duty station. Upon transfer, the records transfer along with the patient. Proper entries must be made on the records, and they must be filed so that they are easily located when needed.

Exercises (002):

1. What is the mission of the USAF Dental Service?

2. Identify the given areas as being professional or administrative services sections by matching each section in column A with the appropriate service in column B.

Column A

____(1) Radiology section.
____(2) Supply section.
____(3) Reception section.
____(4) Training section.
____(5) Examination section.
____(6) Oral health section.

Column B

a. Professional service.
b. Administrative service.

3. What section is essential in reducing lost manpower hours due to dental conditions?

1-2. Organization of USAF Medical/Dental Service

The medical service is arranged in a logical pattern. Understanding the types of medical units is basic for each medic. The medical/dental corps is comprised of many types of people of various ranks and jobs. Each one is an integral part of the corps.

Knowing who you work for or even who your boss has to answer to helps you understand that actions are coordinated and planned with the approval of higher headquarters. Organization is addressed here under the headings of Surgeon General, types of medical treatment facilities, dental service, and sections.

003. Identify the medical leaders in the echelon of the medical corps.

Surgeon General. The Surgeon General, a physician, is the chief of the medical services for USAF. This position carries the responsibility and authority for the proper management of the medical corps. The Surgeon General's office and staff are located in Washington, DC, with some support staff located at AFMSC, Brooks AFB, Texas. The staff consists of deputies and assistants who aid in the management of the corps. The Surgeon General can obtain the rank of lieutenant general but does not have to be a lieutenant general to fill the position.

The next lower echelon is the Command Surgeon. Each command (AFLC, ATC, SAC, TAC, etc.) has a single command surgeon who is in charge of the supervision of all the medical facilities and personnel within his or her command. The Command Surgeon usually holds a general rank. The office of the Command Surgeon is located at the installation at which the command headquarters is located.

The next echelon beneath command is the base level, and the Director, Base Medical Services (DBMS) is in charge of all medical facilities and personnel at this level. The DBMS, like the Surgeon General and Command Surgeon, is a physician but can be a Medical Service Corps officer at smaller facilities. The DBMS is very often referred to as Hospital Commander.

Exercises (003):

1. Where is the Command Surgeon's office located?

2. What medical officer has ultimate responsibility for the medical corps?

3. What is the highest rank the Surgeon General can obtain?

4. What is the meaning of DBMS, and what is another title used for the DBMS?

004. Classify each of the four types of medical treatment facilities in terms of given descriptions.

Types of Medical Treatment Facilities. There are four classifications of medical treatment facilities within the USAF Medical Service (see fig. 1-1).

USAF clinics. A clinic usually has no beds. When it does, they are for quarters-type cases and transfer patients. There are few, if any, medical specialties available other than general practice. Patients are referred to regional hospitals for more complicated treatment.

USAF hospitals. These facilities have some beds and specialties available. Due to limited specialties, some patients are transferred to regional hospitals for treatment.

USAF regional hospitals. The regional hospital treats patients as clinics and hospitals do. It accepts patients for

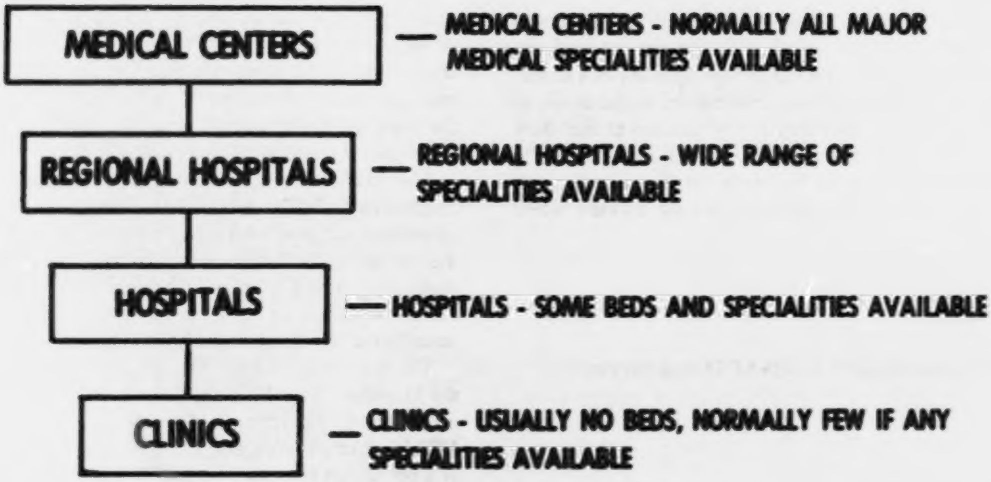
MEDICAL CENTERS
MEDICAL CENTERS - NORMALLY ALL MAJOR MEDICAL SPECIALITIES AVAILABLE
REGIONAL HOSPITALS
REGIONAL HOSPITALS - WIDE RANGE OF SPECIALITIES AVAILABLE
HOSPITALS
HOSPITALS - SOME BEDS AND SPECIALITIES AVAILABLE
CLINICS
CLINICS - USUALLY NO BEDS, NORMALLY FEW IF ANY SPECIALITIES AVAILABLE

Figure 1-1. Types of medical treatment facilities.

treatment from clinics and hospitals in its geographical area if adequate care cannot be provided. Normally, a regional hospital has a wide range of specialties available. Patients requiring treatment not available at these facilities are transferred to USAF medical centers.

USAF medical centers. These facilities normally have all major medical specialties. They accept patients from all the smaller medical facilities within their geographical areas. An example of a medical center you may have seen is Wilford Hall at Lackland AFB, Texas.

One must look at these facilities as a pyramid. At the top is the medical center and at the bottom are the clinics and hospitals, with the regional hospital sandwiched between. The medical centers regulate the transfer of patients from a medical facility in their area to another medical facility.

Exercises (004):

1. Match each phase listed in column B with the classification of medical facility in column A.

Column A

_____(1) USAF Clinic.
_____(2) USAF Hospital.
_____(3) USAF Regional Hospital.
_____(4) USAF Medical Center.

Column B

a. Has some beds and limited medical facilities.
b. Normally has no medical specialities.
c. Has all specialities.
d. Accepts patients from clinics and hospitals.

005. Distinguish between officer responsibilities and command requirements within the dental service.

Dental Service Organization. The dental service organization follows the same pattern as the medical service. The top ranking dental officer's title is Assistant Surgeon General for Dental Services. He or she works directly for the Surgeon General, is a dentist, and is responsible for the entire Dental Corps. The position of Assistant Surgeon General for Dental Services carries the top rank of major general but officers do not have to be that rank to hold the position.

The Office of the Assistant Surgeon General for Dental Services is located in Washington, DC. To aid the general in fulfilling his or her duties, a deputy assistant, two dental staff officers, and an advisor for enlisted affairs are provided.

With the creation of the position, Advisor to Assistant Surgeon General for Dental Services for Enlisted Affairs, the dental enlisted force has a representative in the Assistant Surgeon General for Dental Services office. The enlisted force now has a channel of communication that reaches all the way to the top of the Dental Corps.

Beneath the Assistant Surgeon General for Dental Services are the command dental surgeons. The command dental surgeons oversee the personnel and facilities that are within their particular command (i.e., SAC, TAC, ATC, etc.). Depending on the size of the command, the number of staff, enlisted or officer, that works with the Command Dental Surgeon varies accordingly. Dental command headquarters are located at the base designated as headquarters for the major command. Generally, command dental surgeons are involved with the administration of the dental facilities within their command.

The next lower level of command is the base, and this is generally where you come in contact with management. The dental officer in charge of facilities at a medical center is titled Director, Dental Services. Those who are in charge at hospitals or clinics (see Vol. 1, Obj 004 for types of hospitals) have the title of Base Dental Surgeon. This title is not to be confused with oral surgeon, nor are the duties the same. The base dental surgeon (BDS) is responsible for overall operation of the clinic, but he or she does have many subordinates, officer and enlisted, who carry out his or her policies.

A clinic is logically divided into sections according to treatment administered. Examples are the examination and radiology section, restorative section, preventive dentistry section, oral surgery section, prosthestics, as well as others. Each section has a dental officer in charge to ensure the adequacy of professional treatment. Nontreatment sections, such as dental supply, also have a dental officer to provide guidance if needed. The type and amount of treatment coupled with the clinic size determines the number of dental officers needed to function as chiefs of section. Of course, the larger clinics have more dental officers fulfilling administrative duties than smaller clinics.

Exercises (005):

1. What dental officer is responsible for the entire dental corps?

2. Which level of command is located in Washington, DC?

3. What is the highest rank that the Assistant Surgeon General for Dental Affairs can obtain?

Identify each true statement and explain why the statements are false.

_____4. The Command Surgeon General holds the highest position within the dental field.

_____5. The Advisor to the Assistant Surgeon General for Dental Services for Enlisted Affairs works directly for the Command Dental Surgeon.

_____6. The oral surgeon and the base dental surgeon have the same duties.

_____7. The title of the dental officer in charge of a dental clinic is Base Dental Surgeon.

006. Differentiate between the various supervisors of a dental airman.

The chain of command is made up of progressive levels of authority. Knowing the proper chain of command within a dental facility enables you to solve problems faster by handling situations at the appropriate level. To further understand what is meant by chain of command, let's look at the levels of authority within a dental facility.

The first person in the chain of command is usually your reporting official/supervisor. This is the person with whom you should coordinate military and most working (job related) procedures. Another person, although not an official part of the chain of command but warrants your consideration, is the dentist. This unofficial part of the chain occurs when the dentist's and assistant's duties intertwine because of a common denominator, the patient. The next official link in the chain is the department NCOIC. Your reporting supervisor may not be the NCOIC of the department you are working in, but you are still obligated to coordinate with the department NCOIC on matters which affect the NCOIC's department.

When you arrived at your present duty station, you were assigned a reporting supervisor. This supervisor has the responsibility to ensure that you fulfill your role as an integral part of the USAF dental team. Here is a partial list of this supervisor's areas of responsibility: job performance, morale, OJT, dress and appearance, airman performance reports, and welfare.

Your reporting official (reporting supervisor) may be your NCOIC but does not have to be. In a situation where your reporting official is a different person from your NCOIC, you have two people who are directly responsible for a great part of your career. The NCOIC directs your work efforts and capabilities and channels you to areas that best suit the mission. Your reporting official monitors how well you accomplish your Air Force duties. He or she is responsible for ensuring that you become trained in the areas of your assigned position. You, your reporting official, and NCOIC have one common goal: to accomplish the dental mission. However, because of the human variable, your NCOIC and reporting official have to tailor tasks and jobs to fit your individual characteristics and still fulfill mission requirements.

An unofficial supervisor is the doctor you work with. The dentist has total responsibility for treatment rendered to his or her patient, including treatment that you may deliver within the scope of your duties. If you are working as a chairside assistant for a dentist, then the dentist is your unofficial primary supervisor, but generally not your reporting official and, obviously, not the NCOIC. To further understand how these three supervisors interact to provide a smooth flow of supervision that does not cause severe confusion to workers, let's examine a hypothetical situation.

Airman Harrington works as a chairside assistant with Doctor Walker; Airman Harrington's NCOIC is SMSgt Kibbey, and the reporting official is TSgt Dansereau. Airman Harrington needs to go to the education office during duty hours to check about enrolling in some off-duty college courses. The first person Airman Harrington should check with is the NCOIC of the section or clinic where he works. The next step in receiving approval is to have either Airman Harrington or SMSgt Kibbey coordinate the action with Doctor Walker. Notice that Airman Harrington neither checked nor coordinated his actions with his reporting official. That's because his reporting official didn't have a need to be contacted.

Let's examine another situation involving the same individuals, but this time Airman Harrington has been given a date to take a CDC end-of-course exam at the base OJT office. Again, the NCOIC, SMSgt Kibbey, is informed of the appointment and Airman Harrington's reporting official, TSgt Dansereau, is notified of the exam date. SMSgt Kibbey or Airman Harrington then coordinates the date with Doctor Walker. In this case, all three of Airman Harrington's supervisors are informed of the impending course exam date and time away from the office.

One last situation should help you better understand Doctor Walker's role as a supervisor. Doctor Walker may ask Airman Harrington to go to the medical records section to get the records of an inpatient scheduled for treatment later in the day. No coordination with either SMSgt Kibbey or TSgt Dansereau is necessary if the hospital is connected to the dental facility but, if the dental facility is separate from the hospital, then either Airman Harrington or Doctor Walker must inform SMSgt Kibbey of the reason that Airman Harrington is going to be absent from his duty station.

As you can see, it can be confusing as to who needs to be notified in regard to specific situations. The best thing you can do is keep your NCOIC informed. The NCOIC will either ask that you coordinate with other supervisors or do it himself or herself, as necessary. It must be pointed out that local policy at your dental facility may vary from the preceding examples. Please ensure that you fully understand your proper chains of supervision if they are different from those in the examples.

Exercises (006):

1. Which supervisor is responsible for your performance reports, OJT, and job performance?

2. If a dental assistant is going to be absent from duty, who must be informed?

3. To be absent from duty, from whom must permission be obtained?

Identify true statements and explain why the others are false.

_____4. Your NCOIC can also be your reporting official.

_____5. Time off from the job must always be coordinated with your reporting official.

_____6. A chairside assistant can be temporarily excused from duty by a dentist.

_____7. Any matters that affect a department should be coordinated with the NCOIC of the department.

007. Differentiate between the various sections in a dental facility and describe the section's responsibilities.

Sections. A dental facility is divided into many sections, and each section has specific responsibilities. Obviously, sections that specialize in patient treatment are going to have many responsibilities focusing on patient treatment. Each dental specialty is responsible for accomplishing treatment that concerns the specialty section. Because the scope of responsibility of the patient treatment departments or specialties is generally self-explanatory, time is spent examining those sections or departments having functions that are not quite as obvious.

Dental supply. Besides the responsibility of ordering and issuing supplies, the supply section usually has many other wide and varied tasks. Dental supply is usually tasked with the responsibility of general equipment maintenance. This consists of fixing minor general equipment breakdowns or acting as liaison with repair units capable of extensive or complicated repairs. Dental supply also functions as a knowledge center on various subjects such as mercury hygiene, product safety, and janitorial services. In addition, supply frequently coordinates precious metal recovery, spore tests of autoclaves, and examination of oxygen cylinders located within the dental clinic. Not all of the previously mentioned tasks or items are conducted at each and every dental supply section, nor is the list to be considered complete.

Records and reception desk. This section is the first point of contact between patients and dental personnel. The manner in which the dental patient is received may have a more profound impact upon him/her than the actual treatment. The reception desk is primarily concerned with processing patients in and out of the clinic. Examination of these duties reveals many hidden aspects of the job. Determining patient eligibility, filing records, pulling records for patient appointments, pulling records for departing personnel, maintaining a locator system for certain categories of personnel, inventorying records to ascertain patient dental status categories, answering all incoming phone calls, routing patients for treatment, and many other jobs fall into the records and reception realm of responsibility. The reception desk is usually a very busy place, and personnel normally don't have time for idle conversation; so there may be rules in your clinic prohibiting visitation other than for work matters at the reception desk. Rules are formulated to aid in efficient processing of patients and present a professional atmosphere.

Dental superintendent/NCOIC. Dental clinics may have both a superintendent and NCOIC or just an NCOIC. The position of superintendent can best be described as administrative assistant to the base dental surgeon. When a superintendent is present, the NCOIC functions as supervisor of enlisted personnel. Both a dental superintendent and NCOIC can be found at the larger dental clinics; and generally, the single position of NCOIC is found in the smaller clinics. At a smaller clinic where there is only an NCOIC he or she must fulfill the role of administrative assistant to the base dental surgeon and NCOIC. Because of the complexity and size of large clinics, enlisted supervision and administration may be divided between the positions of dental superintendent, NCOIC, or others in large clinics.

Dental laboratory. The dental laboratory is staffed with personnel holding AFSC 982X0. Support of prosthetic treatment by fabrication of prosthetic appliances is the primary mission of the lab. Laboratory technicians usually are busy making various prosthetic devices and are working against a deadline. For this reason 981X0 personnel should stay out of the laboratory unless specifically invited to enter.

Exercises (007):

1. Match the correct response in column B with the task listed in column A.

Column A

_____(1) Supports prosthetic section.
_____(2) Administrative assistant to base dental surgeon.
_____(3) Acts as liaison with repair facilities.
_____(4) Fabricates dentures.
_____(5) Supervisor that can be found at large and small clinics.
_____(6) Responsible for general equipment maintenance.
_____(7) Answers incoming phone calls.

Column B

a. Supply.
b. NCOIC.
c. Superintendent.
d. Front desk.
e. Laboratory.

2. Briefly describe the duties of each of the following:

   a. Dental superintendent.

   b. NCOIC of dental clinic.

   c. Dental supply.

   d. Front desk.

1-3. History of USAF Dental Service

The best way to become familiar with an organization is through the chronological events. History makes it possible to commemorate special events and to show that every person involved eventually becomes a part of the history for future readers. Chronology begins with the first military dentist, moves to establishment of the Air Force Dental Services, and continues up to our present service.

008. Identify significant historical facts related to the dental service.

First Military Dentist. The first American Armed Force to conscript dentists for military service by legislative means was the Confederate Congress of the South in 1864. The Confederate Congress was prompted to pass a law covering the conscription of dentists because of the relatively high cost of civilian dental care in comparison with the military pay of the Confederate soldier. The fee for a single gold filling reportedly exceeded the 6-months pay of a Confederate private. The rank and pay provided Confederate dental officers were not recorded. It was indicated that those who demonstrated extraordinary skill were entitled to extra duty pay as determined by the Surgeon General. Confederate dental officers were required to furnish their own instruments; however, dental equipment and supplies were purchased from the hospital funds. With the defeat of the Confederate Armies in 1865, legislative means for providing a military dental service became extinct in the United States. It was the policy of the United States Government to make each officer and enlisted person responsible for the care of his or her own teeth.

Contract Dentists. In 1844, Edward Maynard, a prominent dentist from Washington, DC, made the first overtures advocating military dentistry. Actual legislation authorizing the establishment of a US Military Dental Service was not enacted until 2 February 1901. The bill, which became the original law for the establishment of the United States Army Dental Corps, provided for the employment of 1 contract dentist for each 1,000 military personnel served, but the total number of dentists was not to exceed 30. Of the 30 contract dentists ultimately appointed, 21 were required to accept duty assignments at overseas stations. The 9 remaining in the United States were scheduled to provide an itinerant type of dental service to the troops. The contract dentists were paid a monthly salary of $150.00, exclusive of travel expenses, and were permitted to wear uniforms. The medical supply officer bought the dental instruments, equipment, and supplies. Each dentist was allowed one enlisted man from the Hospital Corps as his assistant.

Commissioned Dentists. The value and reception of the original Army Dental Corps were reflected in the Surgeon General's Report to the Secretary of War for the fiscal year ending 30 June 1902. This report disclosed that 13,498 dental treatments and operations had been performed on 9,148 patients from 1 July 1901 to 30 June 1902. The contract dental surgeons' contributions to the military mission were so well recognized that, on 26 November 1909, the Surgeon General recommended in a letter to the

Chief of Staff that their number be increased, and that their social and professional status be improved by conferring commissions on them. On 3 March 1911, the 61st Congress passed legislation which increased the Dental Corps to 60 and authorized first lieutenant commissions with corresponding pay, allowances, and retirement benefits. The support of the Surgeon General and the National Dental Association played a large part in getting this legislation passed.

Reorganization. The reorganization acts on 29 August 1916 and 6 October 1917 put Navy and Army dental officers on equal status with medical officers in respect to rank, pay, promotion, subsistence allowances, and retirement benefits. The creditable contributions of the Army and Navy Dental Corps during World War I (1914–1918) and World War II (1939–1945) won for them praise and permanent recognition in their respective services. In 1949, the Medical Departments of the Army and the Air Force were separated. During the period from 1917 to 1948, the importance of dental service had become well established. This recognition paved the way for the establishment of the USAF Dental Service on 1 July 1949. The following January, the Assistant Secretary of the Air Force approved the creation of the Dental Division as an organization part of the Office of the Surgeon General, Headquarters, USAF. This division was later renamed the Dental Service with the appointment of an Assistant Surgeon General for Dental Service with the rank of major general.

Establishment of the Air Force Dental Service. Under the terms of the transfer order authorizing the establishment of the Air Force Medical Service on 1 July 1949, 424 dental officers were transferred from the Army to the Air Force. General Order No. 51, dated 15 July 1949, established the strength of the Dental Service at 300.

The general Air Force expansion program at the outbreak of the Korean conflict prompted an increase in the authorized strength of this service to 350. During the calendar year 1950, the active Dental Service strength increased to 734. In March 1951, the requirements for dentists were placed at 1,500, and by June 1951 there was a strength of 1,307 dental officers. By December 1951, requirements were estimated at 1,776. The continuing increase in requirements surged and by the calendar year 1954, there was an estimated requirement for 2,052 dental officers. This requirement has gradually leveled off at approximately 1,500. At the beginning of 1959, there were slightly less than 1,800 dental officers, including 465 Regular officers on active duty. General Order No. 24, dated 20 May 1957, announced the allocation of 1,000 Regular dental officer spaces.

Facilities and Equipment. At the time of its separation from the Army Medical Corps, the Air Force Dental Service inherited 1,478 dental operating rooms, most of which were housed in World War II cantonment-type hospitals. They consisted of open bays equipped with many dental units, and small ancillary spaces. In November 1949, new dental building designs were approved for construction and an extensive rebuilding program was undertaken. These new designs provided for more operating space in individual operatories, adequate ancillary spaces, and a functional arrangement of activities and equipment.

Dental Research. In 1953, dental research was established as a validated requirement at the Air Force School of Aviation Medicine, and personnel spaces were provided for research. Many valuable projects and reports have resulted from Air Force dental research. Some of the developments and contributions as a result of dental research include the acrylic eye, the panoramic X-ray, the bleeding and breathing plastic manikin used as a teaching aid in mass casualty care, the air-bearing handpiece, a miniature electronic device to study tooth contact in full dentures, stannous fluoride prophylaxis pastes, intraoral photography, and palatograms related to phonetics in full denture constructions. Dental Investigation Service (DIS) is the current organization title.

Medical Service School. In October of 1950, the School of Aviation Medicine opened a branch at Gunter AFS, Alabama. The Dental Services Division of this branch was initiated in October 1951. No dental courses were offered at that time. The first dental airman course started on 9 June 1952; this was an advanced dental technician course. It was during this time, also, that a dental laboratory course was initiated for the 982X0 career field. The basic dental specialists were taught by the Navy at the Great Lakes Naval Training Center until the first USAF Apprentice Dental Course began on 9 September 1955, at Gunter AFS. On 21 December 1959, the school transferred from Air University Command to Air Training Command. In 1966–1967, the Medical Service School moved to its present location at Sheppard AFB, Texas, and is now called the School of Health Care Sciences.

Present Services. The dental services rendered today are a result of the sum of all past dental experience. New developments and improvements are constantly being adopted. These changes cause dentists to rely heavily on the assistance of enlisted personnel. It logically follows that enlisted personnel will play an even greater part in dental services in the future.

Exercises (008):

Identify each true statement and explain why the others are false.

_____1. The first Dental Corps was only a division of the USAF Medical Service.

_____2. In the American Civil War, the Union was the first to conscript dentists.

_____3. The first Assistant Surgeon General for Dental Services was appointed to the rank of major general.

_____4. The USAF Dental Corps separated from the Medical Corps in January 1950.

_____5. The first dental specialists were taught at Gunter AFS, Alabama.

6. Match the terms in column A with the appropriate statement in column B.

Column A	*Column B*
_____(1) 6-months pay.	a. Put Navy and Army dental officers on equal status with medical officers.
_____(2) 1 for each 1,000.	b. Contributions include panoramic X-ray, air-bearing handpiece, stannous fluoride pastes, acrylic eye.
_____(3) Reorganization acts.	c. Number of first contract dentists authorized.
_____(4) Dental research.	d. Price of a gold filling by civilian dentist.
_____(5) 1500.	e. Approximate number of current dental officers.
_____(6) 300.	f. Ratio of dentists per military served.
_____(7) 30.	g. Regular dentists authorized by General Order No. 51, 15 July 1949.
_____(8) $150 month.	h. Salary of first contract dentists.

1-4. Interrelationship of Medical and Dental Service

Both the medical and dental service are also known as corps. The basic organization is designated Medical Corps. The Medical Corps has the authority to establish rules governing the dental facility. A closer look at areas affecting dental personnel involve duties of the hospital and squadron commander together with necessary details.

009. Determine the interrelationship of the medical and dental service.

Hospital Commander. The hospital commander is in charge of the total base medical facilities. This is the case even if they are geographically separated from the main hospital. The hospital commander is responsible for patient treatment and the physical facilities. He or she has the ultimate responsibility for the care you render to a patient as well as the equipment you utilized. The hospital commander at larger facilities is a physician but at smaller facilities, such as a dispensary, a Medical Service Corps officer (MSC) may be in charge. A MSC officer is an administrative type. The hospital commander's correct title is Director, Base Medical Services.

Squadron Commander. Even though the titles of the hospital commander and squadron commander seem similar, their areas of responsibility are completely different. The squadron commander is concerned with your military image and your progress in fulfilling the role you have chosen for yourself in the Air Force. The squadron commander is a Medical Service Corps (MSC) officer, and he or she is responsible to either the hospital administrative officer or the Director, Base Medical Services.

Details. Many times you will be tasked with details that may seem to be unrelated to your work in a dental facility. An example of this is being detailed to mow the lawn surrounding the hospital. Every member of the medics who has been determined eligible for details has the privilege of helping keep the grounds looking presentable. Even though the dental facility may be physically separate from the hospital, you should expect to receive a grass-mowing detail. This is an extreme example, but it is entirely possible and was pointed out to aid in understanding details. Dental personnel have been known to pull ambulance duty, night duty for emergency rooms, evening administrative duty for the hospital, inspection duty for the hospital, etc. Details are a part of Air Force life and are needed for the efficient and proper management of a medical facility. Be assured that details are allocated fairly among all eligible medical personnel.

Exercises (009):

1. Who, at local level, is responsible for patient treatment?

2. Who is the squadron commander responsible to?

3. What area of responsibility belongs to the squadron commander?

4. Why are details necessary?

5. What category of officer is the squadron commander? Hospital commander?

6. What areas of responsibility belong to the Director, Base Medical Services?

7. What is a proper title of the hospital commander?

8. What do the initials MSC mean?

Career Ladder Progression

ADVANCEMENT in rank and pay are normal desires of most people in the Air Force. To ensure that you have the best opportunity for promotion, a conscientious, thorough training program is provided for you. Whether you stay in the Air Force 4 or 30 years, the rank you obtain comes as a direct result of how well you manage your career. You can progress as rapidly as regulations and your determination allow.

2-1. Progression in AFS 981X0

Training leads to advancement. What you are required to complete is, for the most part, specific. Information essential to your Air Force education, includes the AF Specialty Code and duties of the dental specialist.

010. List the necessary elements for effective management of career progression.

Air Force Specialty Code (AFSC). The Air Force Specialty Code that you now have, 98130, Apprentice Dental Specialist, was obtained after you successfully completed and graduated from the basic dental assisting course at Sheppard AFB. Progressing up the Career ladder to the Dental Assistant Specialist, 98150, is your next objective (see fig. 2-1). To aid you in your quest, the Air Force has entered you in upgrade training (UGT). When you processed in at your first duty station, after graduation from the basic course at Sheppard, you were automatically entered into UGT.

This training consists of completion of this CDC and documented satisfactory job performance. Upon completion of these two portions of your on-the-job-training (OJT), and with the recommendation of your training supervisor and commander, your 5 skill level is obtained, which indicates that you are a skilled member of the dental team.

Your 5 skill level is retained until you are promoted to the rank of SSgt, at which time you become eligible for UGT to the 7 skill level. UGT for the 7 skill level consists of job proficiency training only, because a self-study course does not exist for that level.

In addition to attaining job knowledge, you are required to complete certain professional military education (PME) courses designed to aid you in your military career.

The dental technician course (3AZR98170 002) at Sheppard AFB is available for 5-level personnel with a career job reservation (CJR). The course expands on the knowledge that you already possess about the dental field as well as presenting new advanced information to aid you in your duties.

Upon obtaining the AFSC 98170, your title is changed to dental technician, and your duties are a combination of supervisory tasks and chairside duties. The final rung in the 981X0 career field ladder is the 9 level. At this point you are classified as a dental superintendent (E–7, E–8) or a dental manager (E–9). These positions are 100 percent management and supervision oriented.

Exercises (010):

1. What title and AFSC are awarded to graduates of the primary dental course at Sheppard AFB, Texas?

2. What AFSC denotes a dental technician?

3. What is the title of the highest dental enlisted position?

011. Distinguish between various duties of dental airmen of different ranks and skill levels.

Duties of the Dental Airman. To list all of the duties of a given level of the 981X0 specialty is next to impossible because of peculiar requirements at individual localities. However, the more important duties are summarized in AFR 39–1, *Airman Classification Regulation*. These 981X0 and 98100 duties and responsibilities have been extracted and are given below in the 3- to 9-level upgrade sequence and are indicated by an alphabetic letter.

The duties and responsibilities for both the 3- and 5-level AFSCs are the same. The difference in these two levels is in the depth of knowledge and degree of proficiency. In other words, the experienced 5-level airman is expected to know more about a job task and is expected to fulfill performance requirements of the task better than the relatively inexperienced 3-level airman.

AFSC 98130 and 98150 duties.

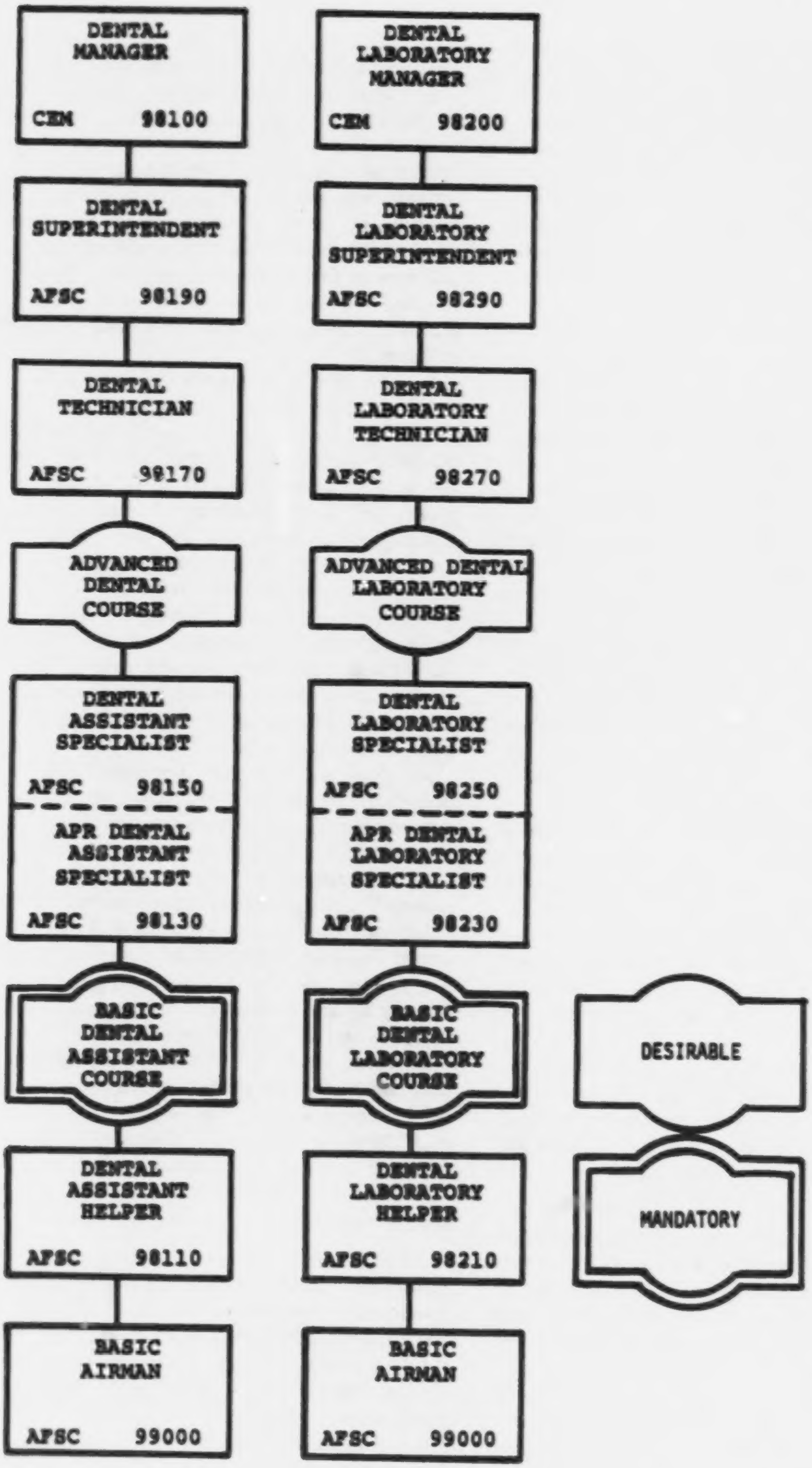
DENTAL MANAGER
CEM 98100
DENTAL LABORATORY MANAGER
CEM 98200
DENTAL SUPERINTENDENT
AFSC 98190
DENTAL LABORATORY SUPERINTENDENT
AFSC 98290
DENTAL TECHNICIAN
AFSC 98170
DENTAL LABORATORY TECHNICIAN
AFSC 98270
ADVANCED DENTAL COURSE
ADVANCED DENTAL LABORATORY COURSE
DENTAL ASSISTANT SPECIALIST
AFSC 98150
APR DENTAL ASSISTANT SPECIALIST
AFSC 98130
DENTAL LABORATORY SPECIALIST
AFSC 98250
APR DENTAL LABORATORY SPECIALIST
AFSC 98230
BASIC DENTAL ASSISTANT COURSE
BASIC DENTAL LABORATORY COURSE
DESIRABLE
DENTAL ASSISTANT HELPER
AFSC 98110
DENTAL LABORATORY HELPER
AFSC 98210
MANDATORY
BASIC AIRMAN
AFSC 99000
BASIC AIRMAN
AFSC 99000

Figure 2-1. Airman Dental Career Field Chart.

a. Assists dental officer in treatment of patients. Receives patients, examines dental record, and prepares for treatment by seating patient, adjusting dental chair, and selecting and arranging instruments and medications for use. Retracts tissues and maintains clear field of operation. Prepares syringe for injection of anesthetics. Prepares materials for making impressions and restoring defective teeth. Makes appropriate entries on individual dental records to indicate condition of oral cavity and treatment accomplished. Performs routine scaling and polishing operations. Counsels individual patients on oral hygiene procedures.

b. Exposes and processes dental X-ray films. Adjusts machine to proper voltage, amperage, and timing. Places film in proper position in relation to area to be X-rayed for intraoral exposures. Aligns cone with film and area to be X-rayed. Places patient in proper position for panoramic exposures. Exposes, develops, processes, labels, and mounts film. Practices and enforces accepted radiation safety standards.

c. Engages in general dental tasks. Sterilizes and cares for dental equipment and instruments. Maintains dental facility. Cleans, lubricates, and makes minor adjustments to dental equipment.

d. Performs preventive dentistry functions. Performs oral hygiene counseling and prophylaxis procedures. Applies topical fluoride and performs other oral hygiene procedures as directed. Counsels patients on oral hygiene techniques. Assists in the clinical, community, and dependent children phases of the Air Force Preventive Dentistry Program.

e. Performs dental administrative and materiel tasks. Maintains filing and publication system and performs clerical tasks in support of professional or general administrative requirements or procedures. Performs as keypunch operator in support of dental services automation requirements. Performs dental materiel functions related to procurement, custodial responsibilities, budgeting, maintenance, and disposition of dental supplies and equipment.

f. Supervises dental personnel. Assigns duties to subordinates and evaluates their work standards and directives. Orients newly assigned personnel in local operating procedures, regulations, and policies. Plans and supervises on-the-job training in dental technical procedures.

AFSC 98170 duties. The duties and responsibilities assigned to the experienced dental technician take on a new dimension. While some of the 98170 duties may overlap the duties of the 98150, the 7 level will be more involved with management and supervision, plus more involvement in oral hygiene duties.

a. Assists dental officer in all dental areas. Provides assistance to professional staff by performing preparatory procedures in patient treatment. Prepares dental instruments, restorative materials, drugs, and medicines. Retracts tissue and irrigates oral cavity. Takes preliminary impressions and pours casts. Measures, records, and monitors vital signs; assists in the management of syncope and other emergency procedures; prepares intravenous infusion equipment. Performs emergency resuscitative procedures. Assists in the operating room. Records treatment and assists in dismissing the patient.

b. Performs oral hygiene duties. Performs oral prophylaxis and periodontal scaling to the depth of the sulcus. Uses dental hand instruments, mechanical instruments, (including ultrasonic), and oral hygiene aids to provide necessary oral prophylactic services. Polishes restorations; instructs patients in mechanics of performing daily oral hygiene. Removes periodontal packs. Selects and applies anticariogenic agents and other medications as directed by the professional dental staff. Assists in planning, developing, and conducting preventive dentistry program.

c. Performs radiographic techniques and duties. Positions film and machine to ensure coverage of area to be radiographed. Exposes intraoral and extraoral films of adequate quality to support all dental sections. Processes, labels, and mounts films. Adjusts voltage, amperage, and timing of X-ray machine. Ensures proper processing techniques and standards. Provides guidance to radiology section and user's maintenance to equipment. Ensures that proper safety standards are applied.

d. Maintains dental equipment. Cleans, sharpens, and sterilizes dental instruments. Performs required testing of sterilizing equipment. Coordinates with appropriate environmental health personnel. Performs daily inspections and user's maintenance of dental equipment. Reports defective equipment or utilities for corrective action.

e. Supervises dental personnel and administrative activities. Plans and schedules duty assignments of subordinates and evaluates proficiency. Evaluates improvement suggestions of subordinates, and makes recommendations to superiors. Assists in determining materiel and personnel requirements. Establishes and supervises work methods and procedures in support of the dental mission. Responsible for supervision of the preparation of reports, records, and communications relating to dental activities. Responsible for administrative currency and accuracy of dental health records, dental data automation input, and other communications. Supervises the operation of the dental materiel section. Orients newly assigned personnel in local operating procedures, regulations, and policies. Conducts on-the-job training, refresher training, and special training on new techniques and methods. Evaluates adequacy of training and capabilities and efficiency of dental airmen.

AFSC 98190 duties. Attaining the highest level of proficiency should be the goal of all airmen. The highest proficiency level for the 981X0 AFSC terminates with the 98190 AFSC. Notice that all the duties listed for AFSC 98190 are supervision and management oriented. When an airman reaches the 9 level, he or she is utilized as a midmanager.

a. Plans and organizes dental activities. Designs and develops dental clinic organizational structures to designate authority and indicate responsibility. Composes local dental regulations and submits to dental surgeon for approval. Develops and improves clinical work methods and procedures to ensure full utilization of personnel and equipment. Establishes methods of preparation, processing, and filing of incoming and outgoing communications. Determines clinical supply and equipment needs and supervises requisitioning, storing, and issuing of dental supplies and equipment. Coordinates dental clinic activities with interrelated departments of medical service and base agencies.

b. Directs dental activities. Plans and schedules subprofessional duty assignments of dental specialists. Controls workload and analyzes clinical procedures. Directs procedures involving preparation, maintenance, and disposition of dental reports and records. Establishes and reviews operational procedures to conform with directives received. Establishes control for maintenance of clinical equipment and compliance with safety regulations.

c. Establishes and conducts on-the-job training for dental personnel. Plans and conducts continuous training programs, including conferences and classes in dental administration and technical procedures. Evaluates effectiveness of training of dental clinic personnel by observation of work performance, written and oral examination, and comparison with current and past operational data. Conducts seminars to familiarize personnel with advances in techniques affecting dental service. Indoctrinates newly assigned personnel to local operating procedures, regulations, and policies.

d. Inspects and evaluates dental activities. Inspects and evaluates administrative and technical practices employed in the dental clinic. Furnishes report of deficiencies and outstanding accomplishments to dental surgeon. Interprets inspection findings and recommends corrective action. Consults and coordinates with dental surgeon for improvement in administrative and technical procedures of dental clinic. Institutes corrective action and maintains followup action to ensure adequacy and compliance.

e. Performs dental activity functions. Resolves problems concerning subprofessional duties. Reviews correspondence, reports, and records of the dental clinic for technical accuracy, completeness, format, and compliance with current directives.

The AFSC 98100, Chief Enlisted Manager (CEM), is awarded to individuals who attain the rank of CMSgt. Basically, the duties are much the same as those of a 98190.

Exercises (011):

1. What regulation contains a summary of the more important duties of an AFSC?

2. What is the difference between the 98130 and 98150 AFSCs?

3. How do the duties of a 98170 airman compare to those of a 98150 airman?

4. What dental AFSCs have specified duties that are all in the area of management or supervision?

5. Match the duties and responsibilities in column A with the AFSC level in column B. Some column B item(s) may be used more than once. Some column A item(s) may have more than one correct answer.

Column A

_____(1) Reviews correspondence and reports for technical accuracy and completeness.
_____(2) Has same duties as 98130 but greater depth of knowledge and proficiency.
_____(3) May perform routine scaling and polishing operations.
_____(4) Interprets inspection findings and recommends corrective action.
_____(5) May polish restorations and remove periodontal packs.

Column B

a. 98130.
b. 98150.
c. 98170.
d. 98190.
e. 98100.

2-2. Career Progression

Knowing what your duties are and what is available to you are part of planning your Air Force career. Rather than taking what's available, it is to your advantage to choose the jobs you prefer. Knowing what to look forward to will help immensely in planning your future. This section details typical clinic jobs available to typical dental personnel by AFSC.

012. Contrast a given list of AFSCs with their respective duties.

AFSC 98130. The majority of your time is spent as a chairside assistant in the restorative section. You may be asked to be a substitute in a specialty section or even an administrative section, but this will occupy only a small portion of your time. As you demonstrate your ability as a chairside assistant, your supervisors take note of your unique abilities. Performing your duties in an efficient, timely manner has a direct influence on what jobs you are asked to perform as you rise in rank and experience.

AFSC 98150. After obtaining the 5-level AFSC, most specialists will be assisting with restorative duties. Those who have demonstrated the ability to assist in specialty sections and who have indicated a preference toward specialty assisting may be given full-time positions within a specialty. Because specialty sections utilize vast amounts of dental materials and instruments that require the assistant's careful attention, only those who have demonstrated this ability are allowed to work there.

As a 5 level you may be tasked to work at the reception desk of the clinic. Again, a unique ability is required. The ability to function under stress, remember names and dates, and especially to be able to interact favorably with other people are requirements for front-desk duty. The reception desk of a clinic must be staffed with people who like people. The reasons for this is discussed in Volume 3, Chapter 1.

X-ray is another section that may require more of your time at the 5 level. It takes a great degree of talent to be able to take a good radiograph the first time. You are to spend a considerable amount of OJT time in the radiography section before you can be allowed to proceed without supervision. This is because a mistake could have serious consequences both for the patient and you.

Dental supply work may be available to you but only at those bases lacking higher ranking midmanagement NCOs. To work in the supply section, you need to exhibit dependability. Supplies are vital to the day-to-day operation of a clinic, so your failure to procure the proper supplies creates a hardship for clinical personnel and also the patient. Those who are unreliable rarely, if ever, have the opportunity to work in Supply.

AFSC 98170. As an accomplished technician, you must spend much of your time as a midmanager and you may be utilized as a preventive dentistry technician. The areas previously mentioned in the AFSC 98150 section are the main areas of work, but you are to be functioning as a working supervisor rather than just a worker. A working supervisor is in charge of a section but also performs as a worker in the section. An example of this is being the NCOIC of the preventive dentistry section and performing prophylaxis procedures on patients in addition to accomplishing the administrative procedures necessary to the proper functioning of the section.

AFSC 98190. At this level, you are either a NCOIC or the dental superintendent of a clinic. All of this work is supervisory and administrative.

Exercises (012):

1. Match the AFSC in column B with the duty in column A.

Column A	*Column B*
______(1) Working supervisor.	a. 98130.
______(2) Performs prophylaxis.	b. 98150.
______(3) Substitute in a specialty.	c. 98170.
______(4) Full-time administration.	d. 98190.
______(5) Full-time supervision.	e. 98100.
______(6) NCOIC of a section.	
______(7) Restoration chairside assistant majority of time.	
______(8) Accomplished technician.	
______(9) Reception desk duty.	
______(10) Worker in X-ray.	

CHAPTER 3

Medical Readiness/Wartime Training

AS MEDICAL PERSONNEL you and your co-workers always have to be prepared for mass casualty situations. The casualties may be the result of a natural disaster, accident or warfare. Constant training is needed to maintain a competent state of readiness and to practice the latest treatment techniques that the different categories of victims require. The training you receive in nuclear, biological and chemical warfare patient treatment may not be needed during a combat situation. However it may be needed because of a nuclear reactor accident, large chemical spill, or a severe spread of disease such as the outbreak of Legionnaires' disease in Philadelphia in 1976. The Air Force has comprehensive plans already in existence that detail specific duties, should a disaster occur. Basic understanding of procedures to use during a casualty exercise or the real thing is essential.

3-1. OPLAN

As stated earlier, the Air Force has a comprehensive plan to deal with mass casualty situations. The Base Disaster Preparedness Operations Plan (OPLAN) is the document that gives a breakdown of duties, including disaster, contingency support, and both communications and operations security.

013. State the purposes of an OPLAN and its annexes.

Base OPLAN. To maximize the effectiveness of personnel and resources during a mass casualty situation, effective guidance is needed. The base commander is responsible for developing standard guidance procedures for disaster conditions and for ensuring that base personnel and resources are fully prepared to meet disaster situations. This guidance is outlined in the Base Disaster Preparedness Operations Plan, which is commonly referred to by its short title, Base OPLAN. The Base OPLAN gives overall *general* instructions for the entire base disaster control program. In this plan, the base commander describes the general condition, states the mission of the base, assigns responsibilities, establishes policy, and prescribes planning factors. The commander also ensures that the various annexes (additions to the Base OPLAN) are developed. These annexes assign responsibility for management of disaster situations to the appropriate units and personnel. One such annex (Annex F) governs the Base Medical Service.

Annex F specifies (1) what the base commander requires of the medical service, and (2) what support will be given to the medical service by other base services. Even though the base commander is responsible for the preparation of this annex, usually the job is delegated to the Director, Base Medical Services.

After the Director, Base Medical Services has completed the medical annex, it is coordinated with other base services. Thus, these services are aware of the support required by the medical service during disasters.

Exercises (013):

1. What is the purpose of the Base OPLAN.

2. What is the full title of the Base OPLAN?

3. What is the alpha designation of the medical annex?

4. Who has the responsibility for developing standard operating procedures for disaster conditions?

5. Why are annexes added to the Base OPLAN?

014. State the purpose and requirements of the Disaster Casualty Control Plan (DCCP).

Disaster Casualty Control Plan (DCCP). To fulfill the requirements of Annex F, medical facilities are required to formulate a Disaster Casualty Control Plan. Every USAF medical facility must have a DCCP to provide guidance to medical personnel regarding preparations for and operations during a peacetime disaster. It provides simple guidance concerning specific tasks and responsibilities that occur during a disaster situation. All medical personnel are required to read the basic part of the plan and any annexes that affect them.

Basic Plan. The basic plan has a list of references such as manuals and regulations, plans and maps, which can be referred to if needed. There is also a list of organizations (military and civilian) that the medical facility relies on for support during a disaster. In addition, there are statements describing the medical mission in a disaster environment, the purpose of the plan, and types of disasters possibly encountered. The last portion is a section describing each major disaster team and references the annex of the DCCP often referred to for each team's responsibilities.

Exercises (014):

1. What is the purpose of the Disaster Casualty Control Plan?

2. Who is required to read the DCCP?

3. What portion of the DCCP would contain the responsibilities of a major disaster team?

4. Which medical facilities need a disaster casualty control plan?

5. The DCCP gives guidance for the management of what type of disasters?

015. State the purpose and requirements of the Contingency Support Plan.

Contingency Support Plan (CSP). While the Contingency Support Plan is separate from the Base OPLAN, it is a plan with which you must be familiar. The Contingency Support Plan is formatted in much the same way as the DCCP, except that the CSP is to be used as a wartime plan. All of the directions in the CSP are formulated as responses to warfare situations. Each USAF medical facility prepares a CSP for guidance to medical personnel. The basic part of the plan provides the general guidance, and the annexes give specific details. All medical personnel must be trained annually in concept of operations from the organization's DCCP and CSP.

Exercises (015):

1. What is the purpose of the Contingency Support Plan?

2. What is the main difference between the DCCP and CSP?

3. Which portion of the CSP contains specific details?

4. How often must medical personnel be trained in the concept of operations of the CSP?

016. Identify the purpose and function of the US Air Force COMSEC and OPSEC programs.

Communications Security (COMSEC). Security is a function that everyone should be aware of. There are basically two security programs in the Air Force and each has a particular purpose. One is to provide actual physical security to those items making up the Air Force combat capability (operational resources). As a dental assistant, it is unlikely that you will be required to participate in this program. However, the other program designed to safeguard classified information and material has a direct bearing on you as a dental assistant.

The safeguarding of classified information is a tank known to most of us. As medics/dental assistants, we at various times have access to patient medical and dental records. These records often contain very personal information that might possibly be used to place the patient in a compromising position. We also work around sedated patients. A sedated patient might inadvertently make statements that is a result of the sedative. The bottom line when dealing with patients and patient records is what you read or hear is *no one's business* except the patients and the doctors. *Never* repeat what you've heard while working around sedated patients or what you might have read in a patients medical/dental record.

Operations Security (OPSEC). The OPSEC program is designed to enhance mission effectiveness by contributing toward the maintenance of an optimum level of overall security for all Air Force operations.

Operations security is an integral part of the larger field of intelligence countermeasures. Intelligence countermeasures encompass all measures taken to provide protection from the intelligence activities of foreign countries and include counterintelligence, OPSEC, and protective security. The OPSEC approach contributes to improving security by identifying vulnerabilities that might otherwise have been overlooked. It supports and complements the counterintelligence, protective security, and tactical deception programs by pinpointing opportunities to apply and optimize effective measures within their respective disciplines. Finally, OPSEC contributes to mission effectiveness by providing an objective basis for countermeasures judgements.

What OPSEC means to you as a dental assistant is again what we covered in COMSEC. Use commonsense about information you read or hear. Be careful not to discuss information on the phone that might be used by persons who do not have "the need to know." Often we as dental assistants forget that our job does permit us limited access to sensitive information and we should always think before we speak about that information.

Exercises (016):

1. What is the purpose of the two Air Force COMSEC programs?

2. How can dental assistants be exposed to classified information?

3. What is the OPSEC program designed to do?

3-2. Field Sanitation

Future circumstances could cause you to live and work in a field environment. Some areas of concern in a field environment include consumable water, dining facilities, living quarters, shower facilities, latrines, and waste disposal.

017. Indicate how military sanitation is maintained in a field hospital.

Consumable Water. Water is always an important item. It is essential for drinking and preparing food. It may be available in abundance but unfit for consumption. Under the direction of the environmental health section, water is tested and treated in necessary abundance for the entire medical facility. Drinking water is usually located throughout the field facility accessible to all personnel. Water is stored in large canvas bags called lyster bags. The bags contain outlets for filling cups and canteens. (If lyster bags are unavailable, substitute containers may be used.) Only water marked POTABLE is to be used for human consumption.

Dining Facilities. Food service personnel provide meals for persons assigned to the field hospital. Mess kits are used by individuals, and it is each person's responsibility to clean their own kit after each use. Large containers with boiling, soapy water and others with boiling rinse water are located near the dining facility for this purpose. Failure to properly clean mess kits could cause serious illness to the user.

Living Quarters. Living quarters will most likely consist of tents. Several individuals are assigned to each tent. Therefore, it is very important for each occupant to keep their specific area clean and free of waste materials, especially food scraps, which attract rodents. The living areas should be free of clutter that could become safety hazards. The area should also be well ventilated. Routine inspections of the living quarters should be conducted to assure that proper environmental standards are being maintained.

Shower Facilities. Personal hygiene is very important in a field facility to maintain health and morale. Efforts are made to provide showers, whether hot or cold, and all person's are urged to use them to protect themselves and others from unnecessary health problems. Water used for showers is generally nonpotable.

Latrines. Latrines for a field hospital may be one of several varieties. They must be properly located and maintained to prevent environmental health hazards. A typical type is the trench latrine with accompanying hand washing setups. After each individual uses the trench, he or she shovels dirt over the excreta. When the trench is filled, another latrine facility is prepared.

Garbage and Rubbish Disposal. Although waste should be kept at a minimum, it still remains a problem. Proper disposal of garbage and rubbish is critical because of the ever-impending insect and rodent problem. The waste materials should be covered in a sanitary fill or burned in an incinerator.

Exercises (017):

1. Which organization directs the preparation of water for a field hospital?

2. Who is responsible for cleaning mess kits, and why must the kit be kept clean?

3. How can we assure that living quarters remain clean and safe?

4. What is a trench latrine?

5. How is drinkable water identified?

3-3. Transportation and Treatment of Injured

The lives of patients, as well as much of the further treatment given, can depend upon the manner in which you transport them following an injury. After initial emergency treatment, patients can be transported by one of several methods, depending on their physical condition and available resources. In this section we cover types of carries, litters, and loading procedure; all relating to caring for shock, hemorrhage, wounds, fractures, and burns.

018. Define hand and litter carries in terms of the purpose and limitations of specified carries.

Fireman's Carry. The fireman's carry is used to move an unconscious patient and is perhaps the easiest carry (see fig. 3-1). This type of carry should never be used for patients who have spinal cord or neck injuries.

One- and Two-Man Supporting Carry. This method of carry is shown in figure 3-2. Although this carry is easy and common, it can be used only on a patient who is conscious. This method of carry must *not* be used on a patient who has fractures of the extremities.

Two-Man Arm Carry. This carry is well suited for lifting a patient onto a litter. It is a good carry for short distances. Figure 3-3 shows the manner in which the patient is held by the two-man team.

Four-Hand Carry. This is a good two-man carry for patients who have head or foot injuries. The patient must be conscious to aid in self support (see fig. 3-4).

Lifting and Loading a Patient Onto a Litter. Figure 3-5 shows how a patient is lifted and loaded onto a litter. Bearers 1, 2, and 3 kneel along the patient's injured side. Bearer 4 takes a position on the opposite side of the litter, steadies it, and gives the command to lift and place the patient. After patients are placed on litters, they are transported feet first, unless they are being taken up steep inclines; in this case they are taken head first.

Exercises (018):

1. What is the purpose of the fireman's carry and the limitations of that carry?

2. What is a limitation in the use of the one- and two-man supporting carry?

3. Which carry is used for patients with head and foot injuries? What limitations would prohibit the use of this carry?

4. When a patient is to be loaded onto a litter, on which side of the patient are bearers 1, 2, and 3 positioned? What does bearer 4 do?

5. When is a litter patient transported head first?

019. Specify how to correctly on-load and off-load patients being transported by ambulance.

On-loading and Off-loading Ambulance Patients. (Refer to fig. 3-6.) Litters are loaded into an ambulance in a head-first position. Bearer 1 prepares the ambulance for the litter. Bearers 2, 3, and 4 load the litter. Bearers 2 and 3 position themselves on each side of the litter at the head of the patient, while bearer 4 takes a position at the foot of the litter. The litter is then raised, with bearers 2 and 3 lifting the litter high into the litter tracks in the ambulance berth. The patient's head must be carefully protected to avoid bumping it on the crossmembers of the tracks. The litter should be slid into place and strapped securely. Bearer 1 should then lock the track and see that all is secure. Top berths should be loaded first, then lower berths. To off-load patients the procedure is reversed.

Exercises (019):

1. Litters are loaded into an ambulance with the patient in what position?

2. How many bearers are required to load and unload ambulance patients?

3. What danger exists when placing a litter into an ambulance berth?

4. Which berths of the ambulance should be loaded first?

020. Identify the types and causes of shock and describe treatment procedures for such patients.

Shock. The term "shock" has a variety of meanings, physiological and otherwise. It is used to denote the receiving of any amount of electric current by an individual. Some people refer to a sudden hemorrhage or

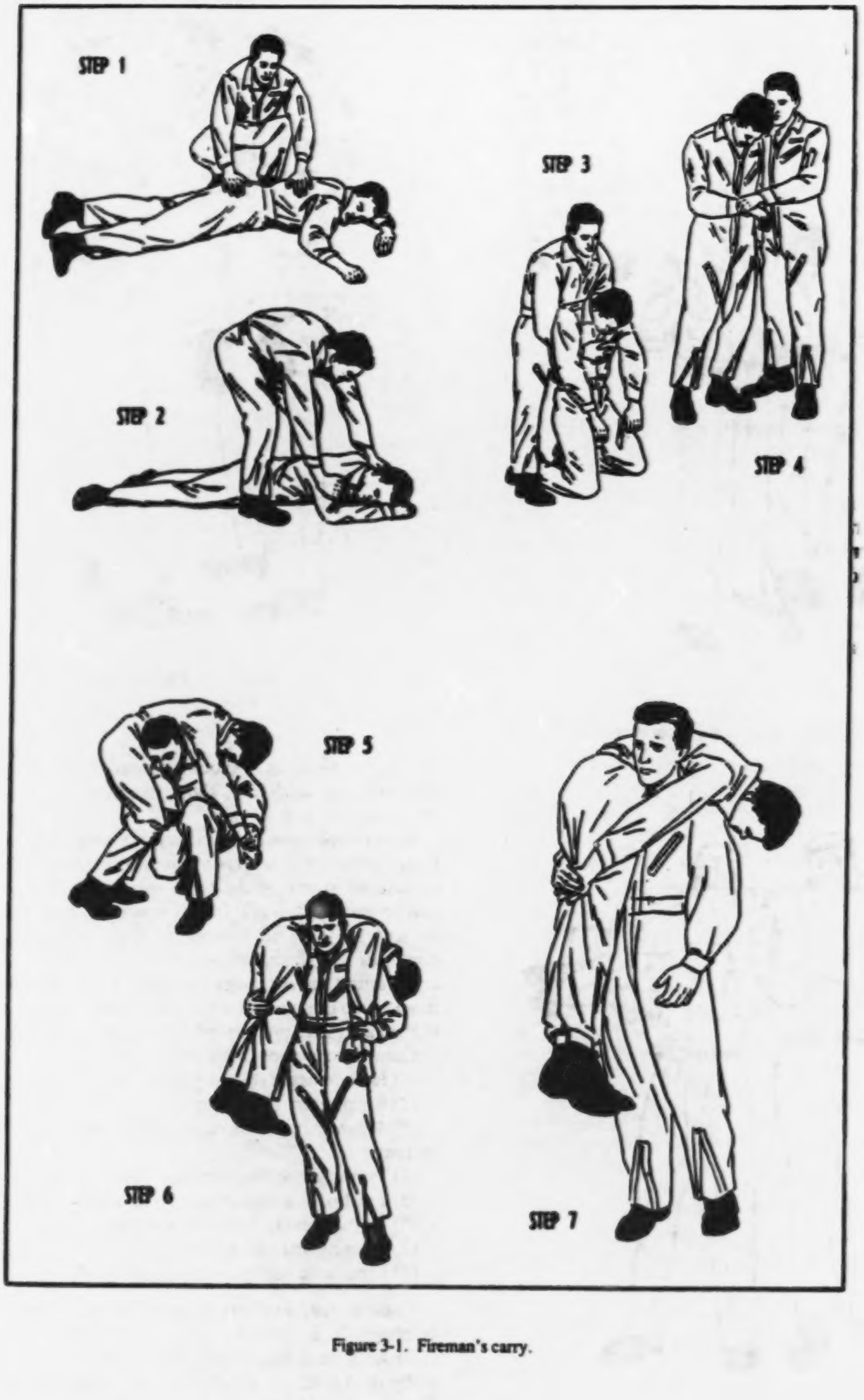
STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
STEP 6
STEP 7

Figure 3-1. Fireman's carry.

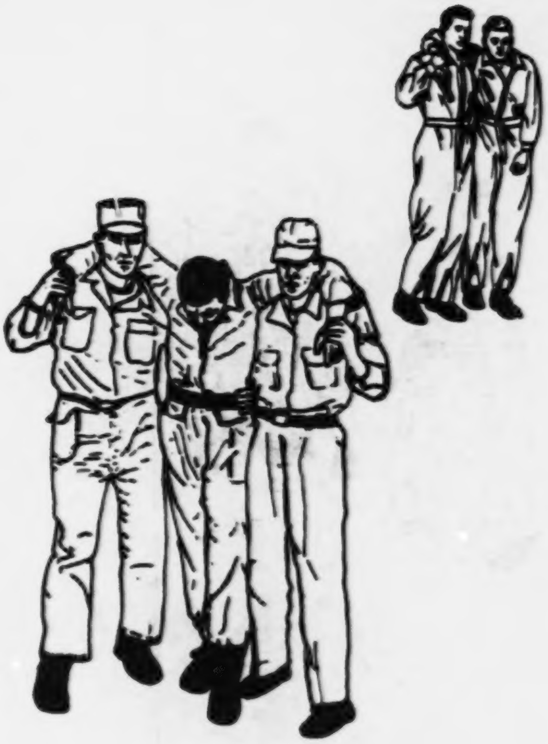

Figure 3-2. One- and two-man supporting carry.

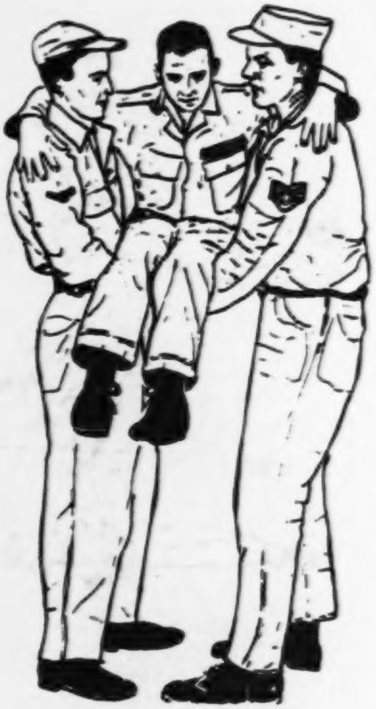

Figure 3-4. Four-hand carry.

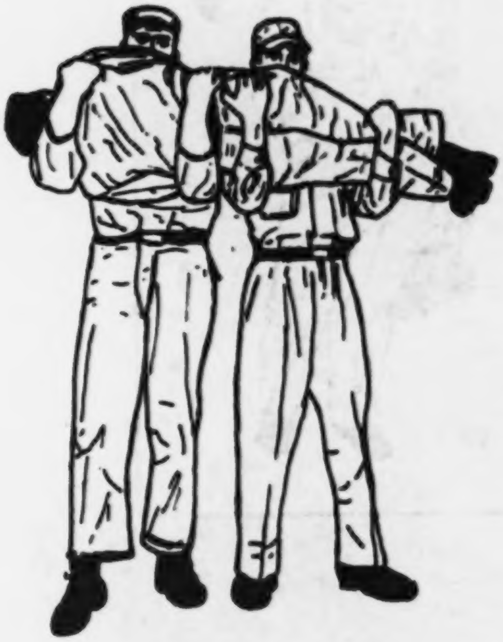

Figure 3-3. Two-man arm carry.

clot in the brain as a shock or more commonly, a stroke. Generally, in medicine, *shock* means a state of collapse of the cardiovascular system.

Types and causes of shock. Shock may accompany many different emergency situations. Ordinarily they can be related to one of the three major causes: (1) The heart can be damaged so that it fails to act properly; (2) blood can be lost so that the volume of fluid within the vascular container is insufficient; and (3) the blood vessels constituting the container can dilate so that the blood within them, even though it is a normal volume, is still insufficient to fill the system and provide efficient circulation.

Common types of shock are:

(1) Hemorrhagic (blood plasma loss).

(2) Respiratory (inadequate oxygen supply).

(3) Neurogenic (loss of vascular control by the nervous system).

(4) Psychogenic (the common faint).

(5) Cardiogenic (inadequate functioning of the heart).

(6) Septic (severe infection and blood vessel damage).

(7) Anaphylatic (allergic reaction).

(8) Metabolic (unbalance of body fluid).

General care and treatment of shock. Once it has been determined a person is indeed experiencing shock, vigorously treat the patient. It is important to recognize the probable cause of shock because treatment is adjusted accordingly. However, many specific principles of initial treatment can be applied to all patients in shock. These principles are listed here:

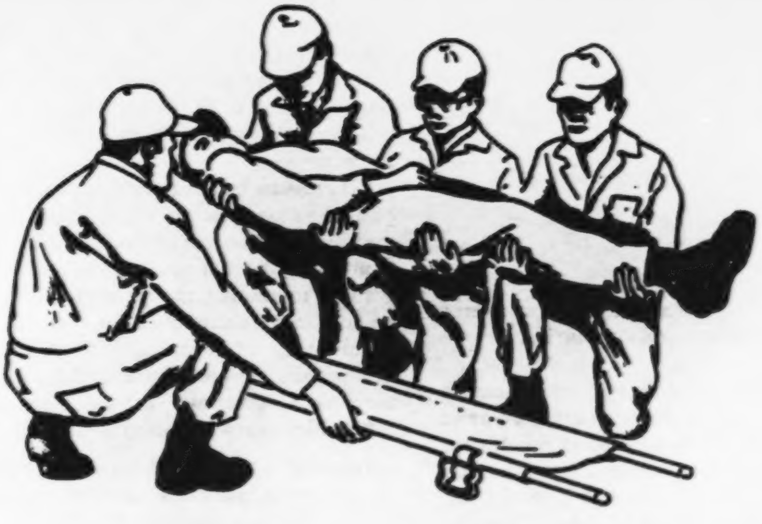

Figure 3-5. Lifting and loading patient onto litter.

(1) Secure and maintain a clear airway and give oxygen as needed. *Do this first, before doing anything else*.

(2) Control all obvious bleeding by gentle, firm compression.

(3) Elevate the lower extremities about 12 inches if the injury does not make this maneuver impossible.

(4) Splint fractures. By doing so, bleeding is lessened, and pain and discomfort, which would further aggravate shock, are minimized.

(5) Avoid rough and excessive handling of the patient.

(6) Prevent the loss of body heat by putting blankets under and over the patient. Do not load the patient with covers or attempt to warm the patient.

(7) In general, keep the patient supine. Remember, however, that some patients in shock after a severe heart attack or with lung disease cannot breathe as well supine as sitting up or in a semisitting position. With such a patient, use the most comfortable position.

(8) Record accurately the patient's initial pulse, blood pressure and other vital signs, and maintain a record of them at 5-minute intervals until the patient is delivered to an emergency facility.

(9) Do not give the patient anything to eat or drink. It is important to check the patient's breathing. Lack of oxygen may rapidly cause shock. Inadequate ventilation may be either the primary cause or a contributing factor in shock.

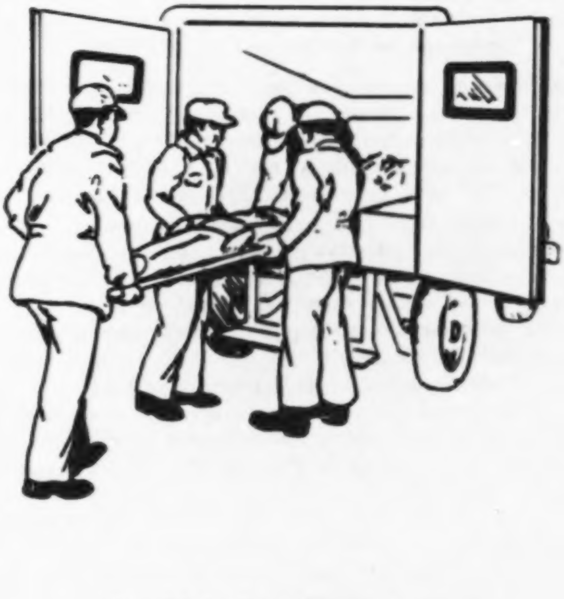

Figure 3-6. Loading patient onto ambulance.

Exercises (020):

1. Match the type of shock listed in column A with it correct description listed in column B.

Column A

______(1) Anaphylatic.
______(2) Cardiogenic.
______(3) Hemorrhagic.
______(4) Metabolic.
______(5) Neurogenic.
______(6) Psychogenic.
______(7) Respiratory.
______(8) Septic.

Column B

a. Blood plasma loss.
b. Inadequate oxygen supply.
c. Loss of vascular control by the nervous system.
d. The common faint.
e. Inadequate functioning of the heart.
f. Severe infection and blood vessel damage.
g. Allergic reaction.
h. Unbalance of body fluid.

2. What is the *first* principle of initial treatment that applies to all patients in shock?

3. What position should a patient in shock be kept?

021. Identify the characteristics and control measures for bleeding from arteries, veins, and capillaries.

Hemorrhage (Bleeding). Hemorrhage and bleeding mean the same thing, mainly, that blood is escaping from arteries or veins. Direct pressure on a bleeding point is the most effective way of controlling hemorrhage. Bleeding may be external or internal. In either case it is dangerous. The average adult body has about 6 liters of blood. The loss of 1 liter of blood in an adult or about 500 milliliters of blood in a child is very dangerous. In an infant, the loss of even 25-30 milliliters of blood can cause signs of shock. Hemorrhage initially results in weakness and, ultimately, if uncontrolled, in shock and death.

Blood is transported within the circulatory system through blood vessels. Injury and some diseases will disrupt the vessels, resulting in bleeding. Characteristically, blood from an artery spurts and is bright red. Blood from a vein generally comes in a slow and steady flow, and its color is much darker. Bleeding from abraded and open minute capillaries is a continuous steady ooze. The rapidity of bleeding is very important. The average adult may comfortably lose a pint of blood donated in a blood donor center in 15 or 20 minutes. During the loss of this blood, the body adapts to its being withdrawn quite well. If larger amounts are lost, especially much more suddenly, the patient may show signs and symptoms of shock, or permanent vascular changes, or may die.

External bleeding. External bleeding is hemorrhage that can be seen coming from a wound. Some examples of external hemorrhage are bleeding from open fractures, bleeding from wounds, and nosebleeds. In most instances bleeding stops naturally from 6 to 10 minutes because the body is provided with many mechanisms of defense, among which are those that arrest bleeding. If a finger is cut, blood will gush from the lacerated vessels. The vessels react by constricting at the cut ends, which will diminish the hemorrhage. A clot then forms at the cut end of the vessel, and the bleeding stops as the clot increases in size and plugs the hole.

In some patients who have undergone a severe injury, the damaged blood vessels may be so large that clots cannot physically occlude them. Sometimes only a portion of the vessel wall may be torn and thus the wall cannot retract and constrict. In these cases, bleeding must be stopped by externally.

Control external bleeding. The control of bleeding is often very simple. Almost all instances of external bleeding can be controlled by applying local pressure. Pressure stops the physical flow of blood and permits normal blood coagulation. There are several ways to control bleeding when it is external.

(1) Direct pressure may be exerted over the wound by a finger or hand or by the application of a pressure dressing; this method is by far the most effective in control of local hemorrhage.

(2) Pressure on a major artery proximal to the wound may be applied to occlude blood flow in that artery. This method may diminish the rate of bleeding but rarely stops it because of arterial collateral circulation around the pressure point.

(3) A tourniquet may be applied proximal to the wound on an affected extremity. However, the use of a tourniquet in instances of bleeding is rarely, if ever, necessary. Tourniquets are not recommended for general use because they have sometimes caused more damage to injured extremities than was caused by the injury itself.

Internal bleeding. Internal bleeding is usually not visible, but it can be very serious and the patient may die of shock. Bleeding from the mouth or rectum or blood in the urine may indicate serious internal injury or disease. Nonmenstural bleeding from the vagina is always significant. Bleeding, however slight, from any body orifice is serious, as it usually indicates some internal source of a hemorrhage that may not be readily evident. Examples of internal bleeding are:

(1) Bleeding from a stomach ulcer.
(2) Bleeding from a closed fracture of any bone.
(3) Bleeding from a lacerated liver or spleen.

The signs that may point to internal bleeding are those that indicate the development of shock.

(1) The pulse becomes weak or rapid.
(2) The skin becomes cold and clammy.
(3) The eyes are dull; the pupils may be dilated and slow to respond to light.
(4) The blood pressure falls.
(5) The patient is usually thirsty and almost invariably anxious, with a feeling of impending doom.
(6) The patient may be nauseated and may vomit.

Control of internal bleeding. The control of internal bleeding depends upon the location of the bleeding site and the cause of the hemorrhage. There is nothing you can do to control internal hemorrhage within the body cavities or organs. You must recognize the liklihood of this event on the basis of the injury sustained and confirm these suspicions by observing vital signs. Immediate transportation to an emergency treatment facility is required for the patient who has suspected internal bleeding.

The principles for treating any patient with suspected internal bleeding at any site are:

(1) Treat the patient for shock from loss of blood.

(2) Anticipate that the patient will vomit. Give nothing by mouth and keep the patient lying down, preferably on one side, with a loosened collar and belt. Make the patient as comfortable as possible, and offer reassurance.

(3) Treat obvious internal bleeding into an arm or leg by applying a splint and local pressure or a pressure splint.

(4) Give oxygen. As blood is lost, the tissues of the body are deprived of their needed oxygen supply. Inhalation of oxygen on the way to the hospital may be lifesaving.

(5) Transport the patient promptly but gently and as efficiently as possible to a emergency treatment facility.

Exercises (021):

1. Briefly describe the characteristics of bleeding from arteries, veins, and capillaries.

2. How is external bleeding controlled?

3. How is internal bleeding controlled?

022. Identify the characteristics of closed and open soft tissue wounds and describe the treatment for each.

Wounds. Most injuries involve some soft tissue, skin, skeletal muscle, or fascia (the fibrous tissue enclosing muscles). Any such injury may be closed or open. *A closed wound* is one in which soft tissue damage occurs beneath the skin but in which there is no break in the surface. An *open wound* is one in which there is a break in the surface of the skin or in the mucous membrane that lines the major body orifices (mouth, nose, anus, and vagina).

Closed soft tissue wounds. A blunt object striking against the body with sufficient force crushes the tissue beneath the skin. Within this tissue a contusion (bruise) develops. It is a closed injury if the skin remains intact. Subsurface damage may extend for varying depths beneath the skin. The injury is followed by the development of swelling and pain. Small blood vessels in the tissues are usually torn, and varying amounts of blood and plasma leak into the wound. The immediate leak accounts for the swelling and the pain. The blood in the tissue gradually migrates toward the skin and causes a characteristic discoloration, an ecchymosis (black and blue mark).

When considerable amounts of tissue are damaged or torn or when large blood vessels are disrupted at the site of the contusion, a lump may develop rather rapidly from a pool of blood collecting within the damaged tissue. This condition is the most severe closed soft tissue injury and is called a *hematoma* or, literally, a blood tumor. In all fractures, a hematoma collects about the broken ends of the bones. With a fracture of a large bone such as the femur or pelvis, more than a liter of blood will be present in the fracture hematoma.

Management of closed wounds. Small bruises require no special emergency medical care. With more severe soft tissue injuries, swelling and bleeding beneath the skin can be extensive and may cause shock. Some control of this bleeding in extremities can be achieved by applying local padding and a soft roller bandage for counterpressure. Local applications of ice may help control initial tissue swelling. If the patient has suffered extensive soft tissue damage, the question of underlying fractures is raised, and such injuries must be sought. Extensive soft tissue injuries of the extremities should also be treated immediately with the use of air pressure splints, which provide support for the extremity and a balanced, distributed counterpressure. When soft tissue injuries are associated with fractures, splinting is a first priority to achieve control of the bone injury and minimize soft tissue damage.

Open soft tissue wounds. Open wounds cause obvious bleeding and are subject to direct contamination, which may result in their becoming infected. There are four major kinds of open wounds of soft tissue with which you should be familiar.

a. Abrasions. An abrasion is a loss of a portion of epidermis (skin) and part of the dermis (skin under epidermis) from its being rubbed or scraped across a hard surface. It is extremely painful, and blood may ooze from injured capillary vessels at the surface. It does not penetrate completely through the skin.

b. Lacerations. A laceration is a cut produced by a knife, razor, or any other object that may leave a smooth or jagged wound through the skin, the subcutaneous (beneath the skin) tissue, the underlying muscles, and associated nerves and blood vessels.

c. Avulsion. An avulsion is an injury in which a whole piece of skin with varying portions of subcutaneous tissue or muscle is either torn loose completely or left hanging as a flap.

d. Puncture wounds. A puncture wound results from a stab with a knife, nail, ice pick, splinter, or any other pointed object, or from a gunshot injury. External bleeding is usually not severe from a puncture wound because the wound is so small. However, these instruments may injure major vessels within body cavities and cause rapid, fatal bleeding within the chest or abdomen.

Management of open wounds. Open soft tissue wounds are treated with regard to three general rules. The order of the treatment is determined by the extent of the wound itself, the severity of bleeding, and the amount of blood lost. Usually one approaches treatment of these wounds in this order:

(1) Control bleeding.
(2) Prevent further contamination.
(3) Immobilize the part and keep the patient quiet.

Bleeding is controlled by the application of a pressure dressing directly over the wound. The application of pressure may be accomplished with:

a. A sterile dressing held by the hand.
b. A sterile dressing held by a pressure bandage.
c. A sterile dressing held by an air splint.

Exercises (022):

1. Describe a closed wound.

2. Describe an open wound.

3. When soft tissue injuries are associated with fractures what is a first priority? Why?

4. Match the type of open soft tissue wound listed in column A with its correct description listed in column B.

Column A	*Column B*
_____ (1) Abrasion.	a. A stab with a knife, nail, ice pick, splinter or any pointed object.
_____ (2) Avulsion.	b. A whole piece of skin with varying portions of subcutaneous tissue or muscle is either torn loose completely or left hanging as a flap.
_____ (3) Laceration.	c. A smooth or jagged wound through the skin, the subcutaneous tissue, the underlying muscles, and associated nerves and blood vessels.
_____ (4) Puncture wound.	d. A loss of a portion of epidermis and part of the dermis from its being rubbed or scraped across a hard surface.

5. Briefly describe the approach to the management of open wounds.

023. Identify the types of fractures and specify procedures for treatment.

Fractures. The most important factor to identify in the initial evaluation of a fracture is the integrity of the overlying skin and soft tissues. Thus, fractures are classified as *open* (compound) or *closed*.

An *open fracture* is any fracture in which the overlying skin has been lacerated. Laceration can occur from the sharp bone ends protruding through the skin or by a direct blow lacerating the skin at the time of fracture. When evaluated, the bone may or may not be visible in the wound. The wound may be only a small puncture or a gaping hole with much exposed bone and soft tissue.

In a *closed fracture* the skin has not been penetrated by the bone ends and no wound exists near the fracture.

It is extremely important to determine at once whether the fracture is open or closed. Open fractures are often more serious than closed fractures because they may be associated with greater blood loss and, since the bone is contaminated by being exposed to the outside environment, the fracture may become infected. For these reasons, all fractures are described as open or closed.

Special terms are used on occasion to describe particular types of fractures, as follows:

a. A *greenstick fracture* occurs only in children and is an incomplete fracture that passes only part way through the shaft of a bone.

b. A *comminuted fracture* is one in which the bone is broken into more than two fragments.

c. A *pathologic fracture* occurs through weak or diseased bone and can be produced by minimal force.

d. A *stress* or *fatigue fracture* occurs when the bone is subjected to frequent, repeated stresses such as running or marching long distances, much as a paper clip can be broken by repeated bending back and forth.

e. An *epiphyseal fracture* occurs in growing children. It is an injury to the growth plate of a long bone that may lead to an arrest of bone growth if not properly treated.

Treatment of fractures. Emergency treatment of fractures takes place after the injured patients vital functions are assessed and stabilized. All fractures should be splinted before the patient is moved unless the patient's life is immediately threatened. Splinting prevents the motion of fracture fragments or of a soft tissue injury, thus reducing pain. Splinting facilitates the transfer and transportation of the patient. Splinting also helps prevent:

a. Further damage of muscle, spinal cord, peripheral nerves, and blood vessels by the broken bone ends.

b. Laceration of the skin by the broken bones, converting a closed fracture into an open one.

c. Restriction of distal blood flow resulting from pressure of the bone ends on blood vessels.

d. Excessive bleeding into the tissues at the fracture site.

A splint can be fashioned from any material. It is simply a device to prevent motion of the injured part. The following general rules of splinting should be understood and followed.

(1) Remove the clothing from the area of the suspected fracture.

(2) Note and record the circulatory and neurological (motion and sensation) status distal to the site of injury.

(3) Apply the splint so that it will immobolize the joint above and below the fracture.

(4) During splint application, allow minimal movement of the limb.

(5) Straighten a severely deformed limb with constant gentle manual traction so that the limb can be incorporated into a split.

(6) If gentle traction increases the patients pain significantly or if resistance to the limb alignment is encountered, splint the limb in the position of deformity.

(7) In all suspected neck and spine injuries, correct the deformity only as much as is necessary to eliminate airway

obstruction and to allow effective application of a splint.

(8) Cover all wounds with a dry, sterile dressing before applying a splint.

(9) Pad the splints to prevent local pressure.

(10) Do not move or transport patients before splinting extremity injuries.

(11) When in doubt, *SPLINT*.

Exercises (023):

1. Match the type of fracture listed in column A with its correct description listed in column B.

Column A	*Column B*
_____(1) Comminuted.	a. Occurs only in children and is an incomplete fracture.
_____(2) Epiphyseal.	b. The bone is broken into more than two fragments.
_____(3) Greenstick.	c. Occurs through weak or diseased bone and can be produced by minimal force.
_____(4) Pathologic.	d. Occurs when the bone is subjected to frequent, repeated stresses.
_____(5) Stress.	e. An injury to the growth plate of a long bone occurs in growing children.

2. What is an open fracture?

3. What is a closed fracture?

4. When does emergency management of fractures take place?

5. What is the purpose of splinting?

6. When in doubt as whether or not to splint, what should you do?

024. Identify burns by type, causes, degree of involvement and specify treatment procedures.

Burns. Burn injuries are generally rated in terms of damage to the skin. Specifically, they are classified in the percentage of surface damage and depth of damage through the various layers of the skin.

There are several types of burns such as thermal burns, burns from electrical current, chemical burns, burns resulting from radiant energy, and systemic reactions to heat. These injuries have only one common factor: that the human organism has received, either locally or over its entire surface, a dose of excessive energy for which its normal protective mechanisms are insufficient.

Thermal burns. The most common type of burn is the thermal or heat burn. The seriousness of the burn can be measured. It depends upon the depth of the burn (depth of the skin injured) and the amount of the body surface involved.

Burns are classified in degrees from one to three. A *first-degree burn* is limited to the most superficial layer of the epidermis and results only in *erythema* (reddening) of the skin. A *second-degree burn* causes damage into but not through the dermis and characteristically results in the appearance of blisters in the skin. In a *third-degree burn*, the skin is destroyed down to the subcutaneous fat. In this type of burn the skin may appear pale, dry, and white, or it may even be brown or charred. Clotted blood vessels may be seen through the skin as though one were looking at them through parchment.

The amount of body surface burned is very important in determining the seriousness of the burn. A very rough but reasonable accurate estimate of the amount of body surface burned is determined by the *rule of nines*. This rule, which applies specifically to adults and older children, divides the body into sections, each constituting approximately 9 percent of the total body surface area.

The care of thermal burns depends on the percentage of body surface involved. In *no* instance should grease (butter, lard, vaseline, mineral oil, or other ointments) be applied to a burn. For first- or second-degree burns you should:

(1) Immerse the burned part in cold water for 2 to 5 minutes if the patient is seen within 15 minutes of the time of injury and the burn involves less than 20 percent of the total body surface.

(2) Cover the burn with a dry, sterile dressing or clean sheet.

(3) Transport the patient promptly to a emergency treatment facility.

For extensive first- or second-degree burns and for all third-degree burns, follow these procedures:

(1) Examine for and relieve any respiratory distress. Always anticipate respiratory difficulty when there are burns about the face and neck or when the patient has been exposed to hot gases or smoke.

(2) Cover the burned area with a sterile dressing or a clean sheet.

(3) Treat the patient for shock if it is present.

(4) Transport the patient promptly to an emergency treatment facility.

Chemical burns. Chemicals that cause severe burns are classified as *acids* or *alkalis*. Strong acids or strong alkalis can burn any area of the body they contact; but they most often contact and affect the skin, mouth, and eyes. Generally speaking, alkali burns are the more serious because these compounds penetrate deeper and cause severe injury.

Strong chemicals burn rapidly; there is no time to waste. The area of contact should be flushed at once with water. Continue to flood the area with water while removing all contaminated clothing as necessary. The most effective flooding is achieved under a large shower head. It may be done effectively with a hose attached to a faucet, but the force of the stream of water should be taken into consideration if a hose is used. A hard blast of water against already damaged skin could cause additional injury.

Electrical burns. Electrical burns may be more serious than they seem at initial observation. In general, the entrance wound is small, but the electric current characteristically destroys a considerable volume of tissue underneath what is an apparently small skin wound. Emergency care for electrical burns consists of covering the burned site with a dry, sterile dressing and transporting the patient to an emergency treatment facility. There are two common burns on the body; one at the point where the current entered the body and one at the point where it exited.

A major complication of electrical burns is *cardiac arrest*, either as cardiac standstill or, more commonly, as ventricular fibrillation. Fibrillation is an uncontrolled and ineffective beating of the heart, which can be produced by a sudden passage of an electric current through it. The local injury in these burns is rarely of immediate concern, but respiratory and cardiac arrest are. Usually respiratory arrest occurs first and, if not promptly treated, is rapidly followed by cardiac arrest. Attention to the patient with an electrical burn must be directed to cardiopulmonary resuscitation first rather than to local care.

The extent of tissue damage, cutaneous and muscular, from electrical burns may not be entirely apparent until some time after the burn has occurred. Characteristically, the damaged tissue dies.

Radiation burns. Nuclear radiation and solar radiation from the sun can both cause severe generalized burns.

Nuclear burns. The exposure of the whole body to a certain, level of nuclear radiation may be lethal. An important point to remember is that when radiation injury occurs simultaneously with a burn, implying that the patient has been close enough to the fireball to have sustained thermal as well as radiation injury, each injury tends to make the other worse.

Solar burns. A solar burn (ordinary sunburn) can require emergency care. First- and second-degree burns are easily incurred when proper precautions against overexposure to the sun are neglected. A person who has received sufficient radiation from the sun to cause many large blisters, in some cases one large overall blister, has sustained a second-degree burn of the surface of the body involved. This person must be treated the same way as for any other thermal burn of this extent and degree.

Heat exposure. People engaged in outdoor activities may become victims of heat exposure. This is particularly true in warm climates, bright sun, or cases of extreme physical exertion. Most people affected by heat exposure are those who are not acclimated to the heat or are not in good physical condition.

Heat is generated through the normal metabolism of food by the body. Vigorous exercise or labor creates more body heat. The body reacts to keep the internal temperature within the normal range by various mechanisms to lose heat. One of these is sweating. Salt and water pass through the sweat glands to the surface of the skin, where the water evaporates. The process of evaporation absorbs heat, thereby helping to cool the skin. Some of the salt is left on the surface and must be washed off the next time the patient bathes. Dilation of the skin capillaries also occurs in an effort to bring the skin blood to the surface, where its heat can be dissipated through radiation and convection, as well as by sweating.

Three specific syndromes result from exposure to heat:

(1) ***Heat cramps*** are painful muscle spasms. These contractions of the arms and legs following strenuous exercise are sometimes seen in people who are otherwise healthy and in good condition. Heat cramps can occur where the temperature is not particularly hot or the sun is not particularly strong.

(2) ***Heat exhaustion*** (heat prostration or heat collapse) is the most common illness caused by heat. These patients are essentially in hypodermic shock. Heat exhaustion is diagnosed by the signs of peripheral vascular collapse: weakness, dizziness, loss of appetite, and nausea. The skin is cold, clammy, and may appear gray. The body temperature may be normal or even below normal. Heat exhaustion characteristically occurs in spectators at outdoor events in extremely hot, humid weather, who, without realizing it, perspire profusely, loosing large quantities of electrolytes and water through the skin, without replenishing their water intake.

(3) ***Heatstroke*** (sunstroke) is the least common but the most serious form of heat exposure. Heatstroke occurs when the body's mechanisms for dissipating excess heat are overwhelmed. The body temperature then rises rapidly, to dangerous and, ultimately, fatal levels. Heatstroke can occur in a vigorous athlete or laborer working hard in a hot environment. The normal mechanisms of the body for dissipating heat include sweating, dilation of the skin capillaries, and respiration. In the exercising individual, the major mechanism for dissipating heat is sweating. In heatstroke, sweating ceases, so this mechanism for heat loss by the body is no longer functioning. The heat then continues to build up in the body through metabolic activity to the point where body cells, particularly those of the brain, are permanently damaged.

Treatment for heat exposure patients is as follows:

(1) Heat cramps—Rest, allowing the patient to cool, and giving water are usually all that is necessary.

(2) Heat exhaustion—These patients should be treated as if they were in mild shock. The patient should be placed supine, with the feet elevated, and taken out of the warm environment. If conscious the patient should be given small amount of water.

(3) Heatstroke—The emergency care of a patient with

heatstroke is to decrease the body temperature as rapidly as possible. This can be accomplished either by immersing the patient in a tub of cold water, by covering the patient with wet sheets or wet compresses and turning a fan on him or her, or by sponging the body with cool water.

Exercises (024):

1. How are burn injuries specifically rated?

2. What is the most common type of burn?

3. Explain the rule of nine.

4. What is the treatment for first- or second-degree burns?

5. How are chemical burns classified?

6. Why may electrical burns be more serious than they seem at first observation?

7. What causes radiation burns?

8. Briefly describe the three specific syndromes resulting from exposure to heat.

025. Associate five methods of heat loss from the body and the steps taken to prevent cold injuries.

Cold Exposure. The human body can only survive within a very narrow temperature range. Human beings can not survive long at body temperatures above 108° F or below 80° F. Ordinarily, proper clothing allows people to survive at temperatures well below 80° F, but, at temperatures near freezing or below, significant cold injuries can occur. Exposures to the cold can injure the body surface, causing local tissue damage, or it can cause profound generalized body cooling and, ultimately, death. Cold injuries are caused by rapid loss of heat from the body—either from a part of it, as when a hand touches a frozen piece of metal, or from the entire body, as when a person is placed in a cold environment.

There are five major ways in which the body may lose heat:

(1) Conduction. Conduction is the direct transfer of heat by contact from the body to a colder object, such as when the warm hand touches a frozen piece of metal or comes in direct contact with ice or snow. Heat is conducted directly from the body to the external object.

(2) Convection. When heat is transferred through air moving across the body surface to a cooler environment, this is known as convection. A person wearing light, summer clothing, standing outside when the temperature drops suddenly, loses heat by convection.

(3) Evaporation. When water is transformed to vapor by evaporation, it absorbs heat. A swimmer coming out of the water feels a cold sensation because of the absorption of body heat by the evaporation of the water. This is also the mechanism by which perspiration cools the body.

(4) Respiration. During respiration, or breathing, the warmed air from the lungs is exhaled into the cold atmosphere, thereby losing heat.

(5) Radiation. Radiation is loss of heat from the body in still air, particularly from the uncovered head. Heat always travels from a warmer to a cooler environment, even in perfectly still air. A person standing still in a cold room radiates heat.

Cold Injuries. Most injuries from cold are sharply localized to the exposed parts of the body. They fall under the general term of "frostbite." Freezing temperatures affect the cells in the body in a predictable fashion. The cell, which is largely composed of water, freezes when it is subjected to excessive cooling, and the resulting ice crystals may destroy the cell. These injuries to different kinds and locations of cells are essentially the same, varying only in the degree and depth to which the tissue exposed has been injured. The three most important factors in determining the severity of a local cold injury are: the duration of the exposure, the temperature to which the skin was exposed, and the wind velocity, or speed.

Freezing of a part of the body—frostbite—occurs when the heat supply to that part of the body is insufficient to counteract the heat loss. Predisposing factors to frostbite include:

a. Inadequate insulation from cold and wind.

b. Restricted circulation because of tight clothing and shoes, or because of underlying vascular disease.

c. Fatigue.

d. Poor nutrition.

e. The use of alcohol.

f. The response of the body to a lowering core temperature by shunting blood, and therefore heat away from the shell to maintain the core temperature.

Treatment of patients suffering from cold injuries varies depending upon the area affected and the degree of cold the area was subjected to. If a slight cold injury (frostnip) is identified early, it can be reversed without tissue damage by firm, steady pressure from a warm hand, blowing hot breath, or holding frostnipped fingers against the body. The area should not be rubbed. With superficial frostbite, the patient should be taken out of the cold and the area carefully, slowly rewarmed, as described for frostnip. With deep frostbite, the patient should be transported to an emergency treatment facility promptly. Treatment for deep frostbite is immediate rewarming.

Exercises (025):

1. Match the method of heat loss listed in column A with its correct description listed in column B.

Column A	*Column B*
_____ (1) Radiation.	a. The direct transfer of heat by contact from the body to a colder object.
_____ (2) Respiration.	b. When heat is transferred through air moving across the body surface to a cooler environment.
_____ (3) Evaporation.	c. When water is transformed to a vapor.
_____ (4) Convection.	d. Warm air from the lungs is exhaled into the cold atmosphere.
_____ (5) Conduction.	e. Loss of heat from the body in still air.

2. What are the most important factors in determining the severity of a local cold injury?

3. What is the treatment for frostnip?

4. What is the treatment for superficial frostbite?

5. What is the treatment for deep frostbite?

3-4. Medical Aspects of Nuclear, Biological, and Chemical Warfare

Medical personnel must be prepared for rendering great service to victims of nuclear, biological and chemical warfare. This section concerns sheltering, casualties, biological agents with protection and treatment, chemical injuries, medical triage, triage categories, and identification coding.

026. Describe medical actions before and after a nuclear attack.

Sheltering. In the event of a nuclear attack, medical service personnel must move directly to predesignated shelter areas. These areas are selected on the theory of high survival rate of those sheltered. Medical personnel must immediately form into preorganized teams having distinct post attack functions. Post attack functions include the monitoring of radiation levels, decontamination of personnel, sorting of casualties, and treatment of the casualties with high probability of survival. Medical facility teams must attempt to repair and salvage any remaining part of the medical facility and to protect it from radiation contamination. In addition, preventive medicine teams must take measures to prevent epidemics.

With due warning, part or all of the medical resources can be moved out of the medical facility to carry out the medical mission at prepared sites or at locations that are considered safer than the permanent medical facilities. Some medical staffs are permitted to remain behind in support of tactical operations.

Exercises (026):

1. List four duties that will be accomplished by medical personnel after a nuclear attack.

2. Where must medical personnel go immediately before a nuclear attack?

3. If sufficient warning of a nuclear attack is available, what must the medical facility do?

4. Which disaster team attempts to prevent epidemics?

027. Describe the casualties expected to result from a nuclear weapon detonation.

Casualties. When a nuclear weapon is detonated, there is an area surrounding ground zero in which the destruction is so great that survival of inhabitants in conventional structures is improbable. Nearly all houses are damaged beyond repair due to blast and accompanying fires. Even reinforced concrete and steel structures suffer damage. Without protective measures, the casualties to the inhabitants of this area are very high. Injuries that are expected from ground zero are both numerous and severe. Radiation poisoning, burns, wounds of all types and severity are to be expected. As the distance from ground zero increases, the number and severity of injuries decrease. It is obvious that all types and degrees of wounds, burns, and radiation exposure are encountered.

Exercises (027):

1. What types of injuries are expected to occur if a nuclear weapon is detonated?

2. Where do most casualties from a nuclear explosion occur?

028. Specify the general characteristics of biological agents.

General Characteristics of Biological Agents. Most biological agents have characteristics not possessed by other weapons. Identification of micro-organisms is difficult and slow because their presence cannot be detected by the unaided senses. They usually have a delayed action effect. Often days must elapse between the time the target is exposed to an agent and the time the first symptoms appear. Some contagious pathogens spread from individual to individual; therefore, personnel not in the area of attack could become casualties. The activity of a biological agent is strictly limited by its ability to survive dissemination and to maintain its virulence under exposure to the environment (air, light, heat, cold, dryness) after dissemination.

Exercises (028):

1. List four characteristics applicable to biological agents.

2. Why is identification of biological agents difficult?

3. The survival of a biological agent is affected by what factors?

029. Specify basic protection and treatment for biological agents.

Protection and Treatment. The principal portals of entry for micro-organisms into human beings are through abrasions of the skin; through the mucous membranes of the respiratory system or gastrointestinal and genitourinary tracts; and through the eyes.

Protection from biological agents rests mainly with each individual. Good personal hygiene protects you and your associates by reducing the spread of disease. Keeping the body and clothing clean is a simple and effective method of reducing the number of disease agents that can enter the human body.

Basic treatment for biological agent contamination consists of removing all clothing and complete cleansing of the body. This is done at a designated point at the decontamination station of a medical facility.

There are numerous biological agents that can harm human beings. The basic treatment is only the beginning of the treatment stage. Competent medical diagnosis and treatment rests with the professional treatment section after the patient has been decontaminated.

Exercises (029):

1. How can an individual protect himself or herself from biological agents?

2. How can biological agents enter the body?

3. What is the basic treatment for biological contamination?

030. Specify the effects chemical injuries have on the body, the emergency treatment to be given, and certain steps to be taken to counteract the presence of chemical agents.

Chemical Injuries. Injuries may result from the use of various chemical warfare agents that have damaging effects on different parts of the body. Some may cause burning and blistering of the skin or eye irritation. Others affect the nervous system when they are inhaled. Symptoms can range from mild headaches, coughing, and blurred vision to laryngeal spasm, convulsions, and coma. Except for eye irrigation and the cleansing and dressing of blisters, there is very little that can be done for these patients in surgery. Bandages are not placed over the eyes following contamination with chemicals, even though some of these patients may require ophthalmic surgery at a later date.

There are few safety guidelines that apply in chemical warfare. Even though these measures are not of a surgical nature, they can be valuable to any member of a military medical team. Their effectiveness depends on the speed with which they are instituted.

a. A field protective mask should be applied as soon as chemical agents are detected.

b. When the air is free of chemical agents, the airway should be cleared by forced deep breathing.

c. Artificial respiration and intramuscular atropine can be used to counteract systemic effects of some chemical agents (when a nerve agent has been used, the specific type must be identified, or a patient may be adversely affected by the use of atropine).

d. Contaminated clothing and masks should be removed before the patient is moved indoors.

e. Eyes and skin must be washed as soon as possible.

f. Personnel who care for chemical casualties in forward areas should wear protective masks, gloves, and clothing.

g. Patients should be removed as soon as possible to uncontaminated areas for continued treatment.

Exercises (030):

1. Name three areas of the body that are highly susceptible to chemical injuries.

2. What symptoms often result when chemical agents are inhaled?

3. What limited procedures are accomplished for superficial chemical injuries?

4. How can the systemic effects of chemical agents be counteracted?

5. How do you protect yourself when working with patients in an area where chemical agents have been used?

031. Associate combat wounds and conditions with the correct medical triage category into which each patient is placed.

Medical Triage. Natural or human-induced disasters almost always produce mass casualties. The type and severity of injuries is dependent upon the kind of disaster. When there is a need for orderly sorting of casualties, medical triage fills this need. Medical triage is the continuing process of classifying and reclassifying the sick and injured according to the urgency and types of conditions presented. It is a system that ensures that the greatest good can be rendered to the greatest number of individuals, in the shortest time, within the means available.

Considerations in triage operations. Effective triage is the key to optimum use of available medical resources. Each medical person triaging casualties should consider the following factors when determining priority for treatment, transportation, and destination of casualties.

a. Capacity and capability of the supporting medical facility.

b. Capacities, capabilities, and locations of other medical treatment facilities.

c. Type and length of treatment procedure each casualty requires as well as the amount and length of postoperative care and chances for recovery.

d. Effect of delayed treatment on each casualty.

e. Effect that treatment or transportation of one casualty can have on other casualties.

Triage Categories. All patients are classified into one of the following categories: minimal; expectant; delayed; or immediate. When a patient is placed in any of these categories, their condition is always subject to change. For ease of remembering, the term "medic" may be helpful (minimal, expectant, delayed, immediate, changing).

Minimal—Those with minor injuries who require some attention, but whose injuries are so slight that they do not usually need a physician. Minor abrasions, lacerations, mild anxiety states, simple fractures of small bones, superficial burns, or partial thickness burns of less than 15 percent of the body are examples of this type of injury. These casualties can be returned promptly to duty. Some personnel with minimal injuries may require little or no medical care, but cannot be returned to duty because they are not self-sufficient. Examples include temporary blindness, moderate anxiety states, and burns of the hands or feet. These conditions are such that they may not require transportation to a medical facility; units or individuals can provide temporary care for them.

Expectant—Those who are hopelessly injured or who require obviously inordinate amounts of medical treatment at the expense of other patients. Examples include extensive head injury with brain involvement or very extensive burns. This category is normally not used in a peacetime disaster unless the facility is totally overwhelmed with casualties.

Delayed—Patients whose injuries do not jeopardize life if definitive treatment is delayed, although recovery may take longer than if prompt care had been given. The injuries require professional medical care, but are such that immediate transportation to a medical facility is not imperative. Examples include closed fractures of long bones and moderate lacerations without hemorrhaging.

Immediate—Those whose injuries demand immediate medical and/or surgical attention to save their lives. Rapid treatment is imperative as long as the patient remains in this category. For many of these injuries, simple treatment is lifesaving; e.g., stopping arterial bleeding, providing an airway, treating a sucking chest wound, and minimizing shock. Some injuries are an immediate threat to life but require prolonged or complicated treatment. Extensive burns, evisceration and critical central nervous system injuries are examples where the chance for survival is guarded even with optimal treatment. If, after emergency medical treatment, the patient's category changes, transportation or further treatment may be delayed if the situation dictates.

Changing. This is not a triage category, but serves as a reminder that conditions of patients change, either as a result of treatment or due to progression of the injury or disease. Therefore, medical personnel should be aware that triage is dynamic and patients must be continually classified as deemed necessary.

Identification Coding. The triage officer examines all casualties and classifies them according to the triage categories. The categories must be readily identifiable. For this reason, a color coded system is often used, and colored clothespins or other markers are placed on litters or clothing. The following colors are used for standardization:

- Minimal — Green
- Expectant — Blue
- Delayed — Yellow
- Immediate — Red

This allows follow-on medical personnel to recognize patients who should be retriaged first, and it also permits medical personnel to refer to "colors" rather than categories in discussing patient priorities.

Exercises (031):

1. Match the term in column B to the correct statements in column A. Use each term once, more than once, or not at all.

Column A	*Column B*
_____(1) Slight injuries that usually do not require a physician.	a. Medical triage.
_____(2) Injuries that demand medical or surgical attention to save a life.	b. Minimal.
_____(3) Injuries that do not jeopardize life if definitive treatment is postponed.	c. Delayed.
_____(4) Those who are hopelessly injured and whose treatment would be at the expense of other patients.	d. Expectant.
_____(5) Classifying and reclassifying of the sick and injured.	e. Immediate.
_____(6) Not a triage category, but serves as a reminder of changing conditions.	f. Changing.
_____(7) Coded green.	
_____(8) Coded blue.	
_____(9) Coded yellow.	
_____(10) Coded red.	

3-5. Ground Crew Ensemble and Field Assembly

During a chemical warfare situation, it is necessary to protect oneself from toxic chemicals. The current approved method of protection is the ground crew ensemble. This section covers limitations and components of the ground crew ensemble and essential components of the USAF minor surgery field assembly.

032. Specify the parts of the ground crew ensemble and its limitations.

Ground Crew Ensemble. The ground crew ensemble is designed to provide chemical defense body protection to Air Force ground support personnel working in a toxic environment.

The ground crew ensemble consists of a two-piece overgarment consisting of a coat (blouse) and a pair of trousers with fly front (pants), overboot, gloves, mask, and hood (see fig. 3-7 and 3-8). It is packaged in a sealed, vapor-barrier bag which provides protection against the elements. The bag includes wearing instructions. The ground crew ensemble has an outer layer of nylon and treated cotton to shed droplets of moisture. The inner layer is made of charcoal impregnated polyurethane foam which provides protection against vapors, aerosols, and small droplets of nerve and blister agents. The ensemble is intended for wear over the duty uniform, but in high temperatures it may be worn directly over underwear. The overgarment is designed to be decontaminated or reimpregnated for reuse.

Limitations. Some of the present limitations of the ground crew ensemble are that it is a physiological heat burden, is not POL (petroleum, oil, lubricant) resistant, not flame resistant, does not afford protection from gamma radiation, replacements are required when it becomes heavily contaminated, can be laundered for training purposes only, has a potential for static electric charge/discharge, and has a shelf life of 5 years.

Components. The ground crew ensemble consists of:

a. Overgarment. The overgarment is a two-piece permeable suit (pants and blouse). The blouse has elastic cuffs, a zipper frontal opening, and snaps front and rear. The pants attach at the waist and ankles via zippers and snaps. The three snaps located at the back of the garment are to prevent separation of the pants and blouse during extreme bending positions.

b. Glove set. The glove set is a double set of gloves. The outer glove is butyl rubber, and the inner glove is of thin cotton to absorb moisture and allow more freedom of movement.

c. Overboot. The overboot is made of black butyl rubber. It is universal size, can fit either foot and is attached over normal footwear.

d. Mask and hood. The M17-series mask is worn for the protection of the respiratory tract against chemical agents. The M6 hood is designed to fit over the M17-series masks and provides protection to the head, neck, and shoulders.

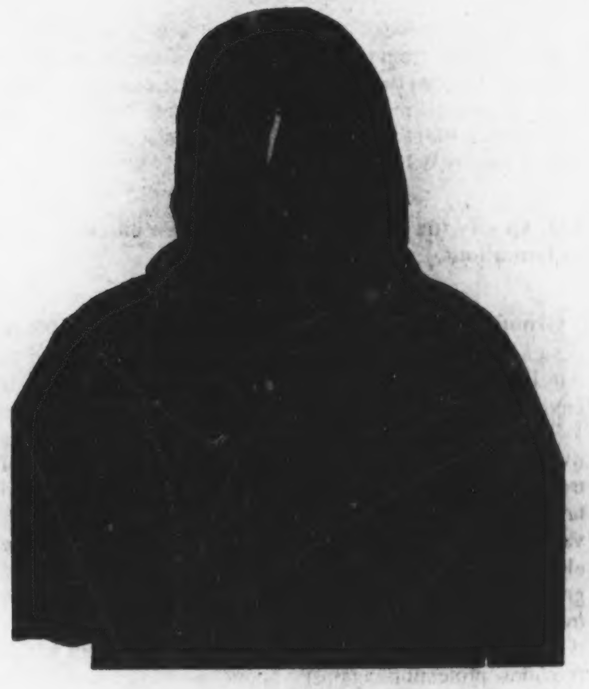

Figure 3-7. Ground crew ensemble top.

Exercises (032):

1. Describe the overgarment of the ground crew ensemble.
2. How many gloves are in a ground crew ensemble?
3. What is the shelf life of the ensemble?
4. List four limitations of the ground crew ensemble.
5. Describe the composition (what it is made of) of the ensemble.

033. Identify basic components of the USAF Minor Surgery Field Assembly.

The USAF Minor Surgery Field Assembly. The USAF Minor Surgery Field Assembly was developed by the USAF Dental Investigation Services (DIS), USAF School of Aerospace Medicine, to meet the needs of the medical readiness mission. The concept of operation is to (1) establish airways and stabilize respiration; (2) control hemorrhage; (3) care for minor injuries so the patient can return to duty (including emergency dental treatment necessary to return the patient to duty); and (4) prepare for evacuation of those patients requiring treatment at the next echelon of care.

Comprehensive, definitive dental treatment is not programmed for field operations; only emergency dental care is planned, freeing the dental provider for more urgent treatment of general casualties. The USAF Minor Surgery Field Assembly was developed with this concept of operation in mind. It is primarily intended to be used for life support by dentists, physicians, and nurses. Secondarily it is used for dental treatment.

The USAF Minor Surgery Field Assembly (see fig. 3-9) is composed of four major components: (1) platform/chair, (2) light, (3) vacuum system, and (4) operating unit. The assembly is packed for storage and transport in two crates

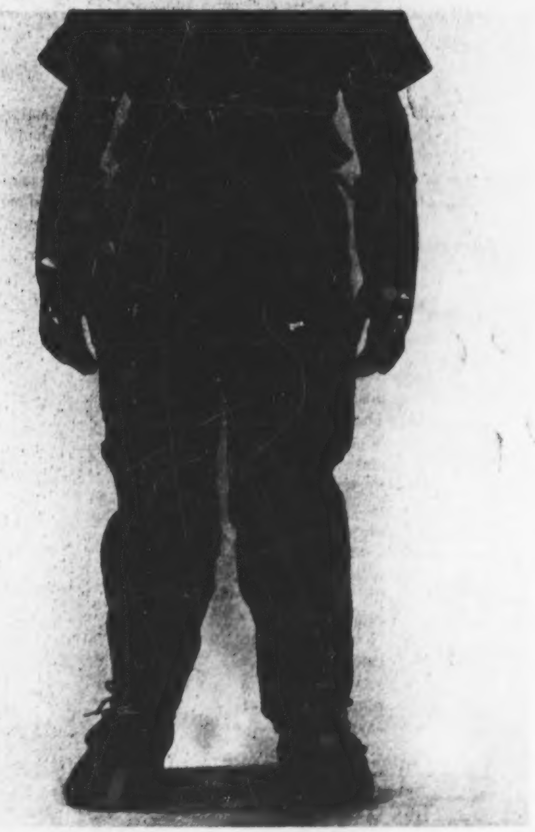

Figure 3-8. Ground crew ensemble bottom.

constructed of wood with carrying handles. The larger crate contains the platform/chair and two operating stools. The smaller crate contains the operating light, vacuum system, operating unit, detachable air-powered instruments, and supporting framework. A brief description of the major components follows.

Platform/chair. The platform/chair is designed to provide a stable adjustable platform for litter-borne and ambulatory patients. To ensure indefinite storage and service life, no hydraulic or compressed gas cylinders are used. Height adjustment and seat-back tilt are accomplished by a side-mounted handcrank and a mechanical, spring-loaded friction lever on the seat-back support. The handcrank raises and lowers the platform/chair height. The seat with the backrest fully reclined, the horizontal attitude of the patient, whether litter-borne or ambulatory, is a Trendelenberg position. The platform/chair is furnished with height-adjustable armrests, equipped with Velcro-retained straps for support needed during the administration of IV fluids.

Figure 3-9. USAF Minor Surgery Field Assembly.

Operating stools. The operating stools contained with the platform/chair are heavy-duty, dental-laboratory-style mobile chairs. The stool is equipped with swivel castors, swivel seat, and vertical height adjustment. Some versions of these stools may have a foot ring attached to the top of the base legs.

Operating light. The operating light is a commercially available Pelton and Crane Light Fantastic II. The commercial product has been modified by the addition of dual duplex (electrical) receptacles on top of the transformer housing of the light arm. These receptacles are powered by the power supply cable from the utility center to the operating light transformer. The light arm allows the light to cover any operation sight presented by a seated, prone, or litter-borne patient. Supplemental-task lighting is also provided by a pair of adjustable lights.

Vacuum system. The vacuum system assembly is a modification of the commercially available A-DEC Air Vacuum System. It is attached to the framework post with a C-clamp-type attachment allowing the system to be installed at any point along the post without disturbing other post-supported components.

Operating unit. The operating unit is a standard commercially available A-DEC 4213 Mini-Trol handpiece-control system for manual control of three dynamic instruments. The instrument holders are bar mounted across the front of the control enclosure. They are adjustable for vertical tilt and unlimited horizontal position within the scope of the mounting bar (see fig. 3-10).

Adjustments for drive air, coolant air, and coolant water are located on the unit faceplate. All on-off volume controls, except those for the drive-air-pressure adjustments, are equipped with dials or toggle handles. The handpiece, or dynamic instrument, selection mode for the unit is manually adjusted by the rotary switch located on the right-hand end of the unit faceplate. An A-DEC 3-way (air-water-spray) syringe is supplied and is located on the mounting bar. All these instruments and the syringe can be field-repositioned to suit the operator, and they are equipped with coiled delivery hoses.

The foot control for the dynamic instruments is the standard wet-dry disk type, with foot-operated toggle switch for on-off control of coolant water to the dynamic instruments. This switch precludes the control in the unit faceplate to prevent breaking the sterile procedure during operation.

The USAF Minor Surgery Field Assembly was developed to meet the needs of the medical readiness mission. Someday, as a dental assistant, you may be called upon to aid in the assembly, operation and disassembly of the unit. Step-by-step instructions are included with each unit. Any further information you require on the assembly can be obtained by contacting the USAF Dental Investigation Service, whose address is the USAF School of Aerospace Medicine, Aerospace Medical Division, Brooks Air Force Base, Texas 78235.

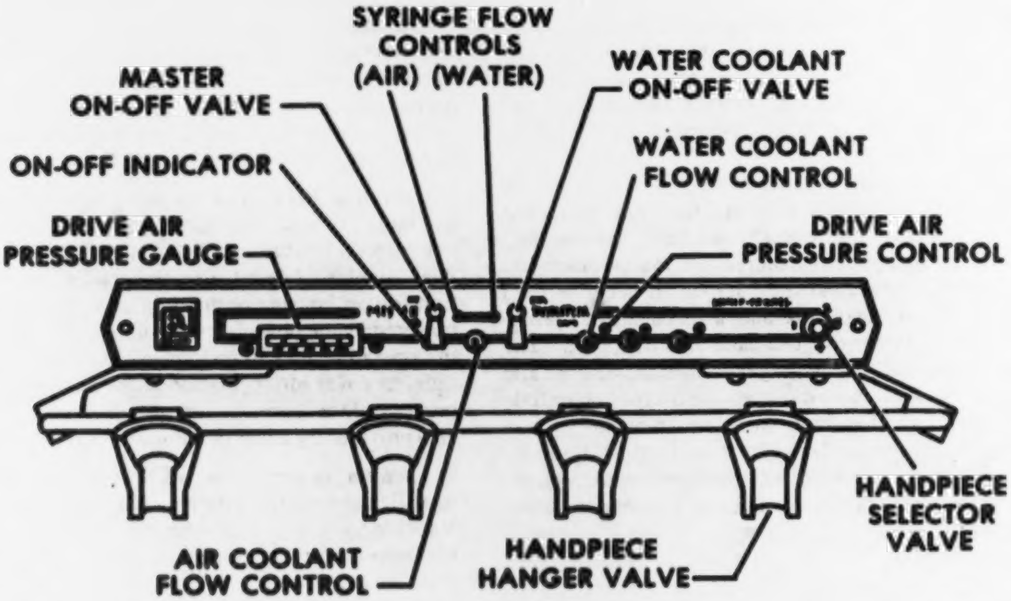
SYRINGE FLOW CONTROLS (AIR) (WATER)
MASTER ON-OFF VALVE
WATER COOLANT ON-OFF VALVE
ON-OFF INDICATOR
WATER COOLANT FLOW CONTROL
DRIVE AIR PRESSURE GAUGE
DRIVE AIR PRESSURE CONTROL
HANDPIECE SELECTOR VALVE
AIR COOLANT FLOW CONTROL
HANDPIECE HANGER VALVE

Figure 3-10. Operation unit.

Exercises (033):

1. What is the operational concept of the USAF Minor Surgery Field Assembly?

2. Why was the USAF Minor Surgery Field Assembly Developed?

3. What are the major components of the assembly?

CHAPTER 4

Air Force Occupational Safety and Health

YOUR CONTINUED safety and health is vitally important to the Air Force. Approximately 88 percent of all accidents are caused by the unsafe acts of people. An additional 10 percent result from unsafe conditions that are allowed to exist after they have been identified. Together with accidents, avoidable illness due to faulty, incomplete, or misunderstood infectious disease control practices cost the Air Force millions of dollars in lost time and medical expenses each year. This chapter is concerned with the Air Force Occupational Safety and Health (AFOSH) program, general clinical work-safety principles, safety hazards that are specific to dental clinic methods and procedures, clean up and/or disposal of potentially hazardous or toxic materials, asepsis, and accident reporting procedures.

4-1. The Air Force Safety and Health Program

This section covers some of the things you'll need to know in order to help make your dental clinic a safe and healthful working environment for all concerned. We begin by looking at the Air Force Occupational Safety and Health (AFOSH) Program, with its offices of primary responsibilities, local responsibility, and surveys and inspections.

034. Identify the origin of Air Force Occupational Safety and Health (AFOSH) standards, to include the OPRs and authorities responsible for implementation.

Air Force Occupational Safety and Health. The Occupational Safety and Health Act (OSHAct) of 28 April 1971 directs the Department of Labor to develop and enforce standards to ensure safe and healthful working conditions for all employees in the private sector of the American work force. Section 19 of OSHAct directs federal agencies to have and use comprehensive occupational safety and health programs that are consistent with those areas in the OSHAct that apply to the civilian work force; AFR 8-14, *Air Force Occupational Safety and Health (AFOSH) Standards*, prescribe the conditions and methods necessary to provide a safe and healthful working environment for Air Force members.

Offices of Primary Responsibility. The Office of the Inspector General (IG), HQ USAF, is the OPR for the safety aspect of AFOSH, and the Office of the Surgeon General (SG), HQ USAF, is responsible for health.

Local responsibilities. Locally, unit commanders, functional managers, and supervisors implement occupational safety, health, fire, and accident programs in their areas of responsibility.

Surveys and inspections. Wing, group, and installation authorities conduct occupational safety, health, fire, and accident surveys and inspections in all workplaces at least once a year, and in high-hazard workplaces at least twice a year. These inspections and surveys may be conducted with or without prior notice.

Exercises (034):

1. What do the letters AFOSH stand for?

2. What personnel have the local responsibilities for implementing occupational safety, health, fire, and accident programs?

3. How often should your workplace be inspected?

4-2. General Safety Principles

While it is difficult to prevent all mistakes, those that lead to loss of limb or loss of life must be prevented. For this reason, the following nine principles of safety, beginning with preoperational training and ending with preoperative planning, are designed to alert you to safety consciousness.

035. Clarify how your become familiar with new equipment without relying solely on your supervisor.

Preoperational Training. Naturally, you must know the proper way to operate equipment if you are to do it safely. Preoperational training is the training you should receive before operating equipment. You are taught this either in a formal technical course or by your supervisor in on-the-job training—perhaps both, as time goes on.

Preoperational training is especially important if you acquire new equipment. Don't assume that because you are a skilled operator of the old equipment, you can operate the new equipment equally safely and well. Since such things as operating speeds, operating controls, and guards may differ, you must read the operating instructions for the new equipment very carefully. This first principle of safety demands that you know your equipment and know how to operate it safely. Be sure to ask your supervisor for instructions and read the operating instructions before you operate any new or unfamiliar equipment.

Exercises (035):

1. Who teaches the training you should receive before you operate equipment?

2. What is the first principle of safety regarding the use of either new or familiar equipment?

3. What is an alternate way for you to familiarize yourself with new equipment other than by relying solely on your supervisor?

036. Define self-discipline as it relates to safety and explain who has the primary responsibility for performing a safety check of equipment in your work area.

Discipline. The second major principle of safety is discipline. Self-discipline is best. Primarily, self-discipline means that you are thinking for yourself. On the other hand, outside discipline means that someone else is doing your thinking for you. So, for our purposes, the meaning of good discipline is self-discipline.

To illustrate the point of self-discipline, let's consider electrically powered equipment. In any facility, the supervisor and his or her personnel should check electrically powered equipment for frayed wiring, loose connections, and proper grounding. Who has the primary responsibility for checking the equipment you use in your clinic? The answer, of course, is *you*. This is because the supervisor simply cannot check all equipment each time before it is used. Consequently, you must use self-discipline in this area unless you wish to risk your life.

Exercises (036):

1. What is meant by the term "discipline" as it relates to safety in the dental clinic?

2. Who has the primary responsibility for performing a safety check of equipment in your work area?

037. Clarify the general safety principle of alertness.

Alertness. A third principle of safety is alertness. Constant alertness is a prime prerequisite in avoiding accidents.

Fundamentally, alertness means paying attention to what you're doing, not just now and then, but all the time. Unless you pay close attention, you may do something wrong, resulting in an accident.

The principal enemies of alertness are external and internal distractions. These are distractions that occur outside and inside of you, either mentally or physically. You must do your best to keep from being sidetracked by every distraction that comes your way.

Exercises (037):

Identify each true statement and explain why the others are false.

_____(1) Alertness is of minor importance in avoiding accidents.

_____(2) The principal enemies of alertness are external and internal distractions.

038. Associate unsafe working practices that should be avoided with specific work situations.

Avoiding Unsafe Practices. A fourth major principle involves avoiding unsafe practices. While it is not practical to discuss every kind of unsafe practice, we can consider some of the most common types of unsafe practices that occur in operating equipment, while using instruments and while handling materials. In addition, we can mention the general safety principles that apply.

According to the National Safety Council, faulty handling of equipment and material is the major source of injuries on the job. Most of these injuries are back injuries caused by improper lifting of heavy objects. When lifting heavy objects, the main point to remember is not to bend your back, if you can avoid it. Keep your back as straight as possible. The idea is to *lift with your legs, not your back*. Squat down, get a good grip underneath the object, then lift slowly with your legs.

Another unsafe practice is working too fast. You can work too fast at any job you do in the Air Force. Work at a moderate, consistent pace whenever possible. Undue haste may cause a mistake in judgment and result in an accident.

Still another unsafe practice is using an instrument for a purpose other than that for which it was designed. For example, it is unsafe to use a dental chisel as a screwdriver. Its cutting edge is likely to slip off the screw and lacerate some part of your body. You may also ruin the chisel in the process.

The way you use knives can be unsafe. It is potentially unsafe, for example, to cut toward yourself. A slight slip may cause you to cut yourself severely. Always cut *away* from yourself after making *sure* that no one else is in the cutting path.

Exercises (038):

1. Match each safe or unsafe practice listed in column A with an action in column B.

Column A

_____(1) Cut away from yourself and others.
_____(2) Bend your back but not your legs.
_____(3) Get a good grip on the top of the object; lift suddenly, with the back serving as a fulcrum.
_____(4) Use a handy dental chisel to loosen a screw.
_____(5) Performing a task so rapidly that a mistake in judgement occurs.
_____(6) Lift with your legs, not your back.
_____(7) Work at a moderate consistent rate.
_____(8) Keep the cutting edge toward you.

Column B

a. Lifting objects.
b. Working at correct pace.
c. Using handtools or instruments for approved purposes only.
d. Using knives.
e. A safe practice.

039. Identify the general safety principles of mental and physical fitness.

Mental and Physical Fitness. Maintaining mental and physical fitness is the fifth principle involved in avoiding accidents and promoting safety on the job.

Mental fitness. The mental fitness aspect of safety is complex, to say the least. Much has been written about the subject, and there are many different views about it. Generally speaking, mental fitness may be approached in the same way as physical fitness. Your physical body needs proper nutrition, exercise, and rest, and so does your brain. Make sure that you use only properly prescribed drugs, and get appropriate exercise and rest.

Physical fitness. Just as impaired mental fitness can result in accidents, so can impaired physical fitness. Get plenty of rest before each day's work, eat balanced meals, and participate routinely in a physical exercise program. Faulty sight or hearing is a prime cause of accidents. If you notice blurred vision or a decrease in hearing, arrange for a medical appointment. Do all you can to stay as healthy as possible. This helps reduce the probability of an accident as a result of physical deficiencies. It also relieves you of worries about your physical condition. Worrying can decrease alertness and cause accidents.

Exercises (039):

Identify each true statement and explain why the others are false.

_____1. Poor mental fitness and poor physical fitness are *NEVER* causes of accidents.

_____2. Mental fitness includes using only prescribed drugs and getting appropriate exercise and rest.

_____3. Staying as healthy as possible reduces mental worries that could cause accidents.

040. Clarify what you can do to avoid common physical hazards associated with dental clinic work.

Hazard Avoidance. The sixth major safety principle is to recognize physical hazards that exist in the dental clinic and then take the necessary steps to eliminate, reduce, or avoid them.

Equipment and instrument hazards. Among the more obvious physical hazards you may expect to encounter in the dental clinic are the dangers imposed by the moving parts of equipment and the hazards associated with the use of dental instruments. Proper handling and precautions on your part can eliminate or reduce any hazards involved. Most obvious dental equipment hazards can be dealt with by making maximum use of proper operational procedures.

Fire hazards. A major physical hazard is a fire. Three elements are necessary in order for fire, the chemical reaction of combustion, to take place. The elements are fuel, oxygen, and heat. Before you can have a fire, you must have fuel. In order for combustion to occur, sufficient oxygen must be present. However, fuel and oxygen alone are not enough. The third element requirement is heat. Therefore, with fuel that is hot enough, together with sufficient oxygen, combustion, or fire, does occur.

To prevent a fire in the clinic, control flame sources such as torches and burners; do not use flameable materials around fire or heat sources; and ensure all gas hoses, valves, and connections do not leak and are in good working order.

The secret of extinguishing a fire is to remove any one of the three elements necessary for combustion. Better still, keep all three of these elements from getting together simultaneously, except when necessary, and you will prevent an accidental fire from starting.

Exercises (040):

1. What can you do to reduce injuries due to physical hazards that are common in the dental clinic work environment?

2. What can you do to reduce or eliminate the hazards associated with equipment and instruments?

3. What can you do to guard against accidental fires in the dental clinic?

041. Specify how lax equipment maintenance can result in safety hazards.

Proper Equipment Maintenance. The seventh major principle of safety is to keep machines and equipment in good operating condition. If any machine is not in good condition, one or both of the following situations may occur: (1) loss of job efficiency, since you won't be able to turn out as much work; or (2) a safety hazard.

Regardless of the type of equipment that you may be operating, watch out for any "play" that may result from such conditions as loose nuts, worn parts, or working parts getting out of adjustment. Any of these conditions can cause "play" to develop, and this could become a safety hazard (because of parts falling off, for instance).

If you're using any kind of cutting instrument, the cutting edges should be sharp. Any cutting edge that is dull may slip or break and cause an injury.

On electrically operated machines, switches must be in good condition. A defective switch might be an electrical hazard resulting in a shock, or it might keep you from stopping a machine when you want it stopped, thus causing an accident.

Before operating any machine or piece of equipment, become thoroughly familiar with its parts and familiarize yourself with the safety hazards that may develop as a result of defective or worn parts. Know what hazards to look for and look for them before and after each use.

Exercises (041):

Identify each true statement and explain why the others are false.

______1. A sharp cutting edge on an instrument is more likely to slip and cause an injury than a dull edge.

______2. "Play" caused by loose nuts (or by worn or out-of-adjustment parts) can cause a piece of equipment to become a safety hazard.

042. Identify how the working environment in the clinic can influence job-related safety hazards.

Safety-Oriented Environment. The eighth major principle of safety is that the working environment should be conducive to safety. Your immediate surroundings (environment) can help or hinder you from a safety standpoint. Under the topics of physical fitness and physical hazards, we have presented several elements of the total environment. Good housekeeping in the workplace is another element you need to be aware of.

If floors or countertops are cluttered with instruments and debris, the chances of an accident occurring are increased. It is important to keep floors and countertops clean from such matter as oil, grease, paints, chemicals, and anything else that may pose a safety hazard. You should also keep hand instruments and other equipment clean. If these items are greasy, they may slip and cause an injury or accident. Aside from keeping items clean, good housekeeping means keeping instruments, materials, and other equipment you use properly stored and in good (working condition) order. A working environment that is cluttered with instruments, debris, and materials poses a safety hazard that is easily avoided with proper care and housekeeping techniques.

The layout of equipment is another important safety factor. Equipment should be positioned so that you will have sufficient space to handle the materials you're working on without creating a hazard to yourself or others.

Exercises (042):

1. Match each condition listed in column A with the appropriate reference listed in column B.

Column A	*Column B*
______(1) Floors and countertops cluttered with waste.	a. Good housekeeping.
______(2) Keep floor and countertops free of oil, chemicals, or other debris.	b. Layout of equipment not directly involving housekeeping.
______(3) Keep hand instruments or equipment clean, properly stored, and in good working order.	c. An undesirable condition.

Column A *Column B*

_____(4) Position equipment so that you have sufficient working space without creating hazards.

_____(5) Position equipment so that you can be alert to what is happening around you.

043. Distinguish between preoperation planning and safety instructions.

Preoperational Planning. The ninth and last principle we cover is planning. Proper planning must precede operation. No matter what you are getting ready to do, you should think about it and plan your activity properly so that you can observe necessary safety precautions. The amount of advance planning you do depends on the nature of the task. Some jobs require more advance planning than others. All jobs, however, regardless of their relative size, require at least some preplanning.

The most important thing to bear in mind when planning to start a job is to check any pertinent safety instructions. These instructions may concern the materials you work with, protective clothing, or the type of equipment that you use. Be sure to study safety instructions carefully, especially if the job or equipment is new to you. As you begin each day's work, even on comparatively simple tasks that you are familiar with, it's a good idea to plan ahead to ensure that all necessary safety principles are observed. If protective clothing, safety glasses, and other protective items are called for, are they available to you? In brief, is everything "shipshape" for the day's work?

Whatever the job is you are assigned to, look for the nine principles of safety you have just studied. If you are *safety conscious*, you'll find them. Remember, "The life you save may be your own."

Exercises (043):

1. What is the most important thing to bear in mind when planning to start a job?

2. Before you begin a job, you should check pertinent safety instructions. What can these instructions deal with?

4-3. Job Safety in the Dental Clinic

This section is concerned with job safety, particularly associated with materials such as mercury, together with infection and burns. We also cover what constitutes reportable and nonreportable mishaps.

044. Identify mercury hazards and necessary safety precautions within the dental environment.

Mercury. Mercury is a liquid at room temperature. Increased heat causes it to change to vapor. Because mercury is not readily absorbed in the liquid state, the main potential hazard is in the form of mercury vapor. Mercury toxication is encountered by dental personnel primarily from two sources: direct absorption into the tissues through contact or handling of mercury and mercury-containing compounds or through inhalation of vapors that are emitted through a volatilization of mercury and mercury-containing substances.

Mercury contamination in the dental clinic is not always associated with noticeable gross spills. Over a period of time, as a result of continuous small leaks or spills that go unobserved, an accumulation of contaminating mercury can reach unsafe levels. Spills and vapors must be kept at a minimum. This requires that specific rules be followed.

Ensure mercury or amalgam is not heated or stored near heat sources. Heat causes the mercury to vaporize. Grinding or polishing amalgam creates heat as a result of friction, which in turn produces mercury vapors that are easily inhaled by the dentist, assistant, and patient. To avoid concentrations of mercury vapor during these procedures, use water spray as a coolant/flush, while simultaneously providing evacuation with the high volume evacuator. In addition to removing the water used as a coolant/flush, the high volume evacuator will remove large amounts of contaminated air from the working area.

Dental amalgam should be prepared over a large lipped receptacle such as a stainless steel or plastic tray or a cabinet well deep enough to contain any spillage. The receptacle should be impervious to mercury and should be cleaned each day to prevent an accumulation of mercury and subsequent vapors.

Mercury spills must be cleaned immediately utilizing the latest directions and techniques available. AFR 162-1, *Management and Administration of USAF Activities*, along with the Dental Investigation Service at Brooks AFB, Texas, provide information on cleaning techniques. You should become familiar with your clinics local policies and always notify your supervisor or NCOIC of any mercury spills as soon as possible.

If available, precapsulated amalgam should be used. The chance of mercury spills is virtually eliminated and vapors are reduced during trituration. If precapsulated amalgam is not available at your clinic then use a minimal mercury technique, which uses only the amount of mercury necessary to provide a proper mix of amalgam. Capsules in which amalgam is mixed require frequent inspection. Edges of the capsule that fit together should be free of any scrap amalgam that has lodged there from previous mixes. This slight buildup of amalgam may prevent the capsule from closing properly. To check a capsule for leakage, place a drop of mercury in the capsule, close the capsule and wrap a piece of autoclave tape or masking tape around the seam. Place the capsule in the amalgamator and run it through a cycle. After the cycle is complete, remove the tape from the capsule and inspect the tape for mercury, especially the area that covered the seam. A leaking capsule readily reveals itself through this test procedure. Any capsule that leaks must be disposed of immediately. Follow your clinic's local policy on disposing of capsules.

Checking for leaks is not limited to capsules but must include the mercury dispenser too. If you notice small drops of mercury laying around your amalgam storage or preparation area, the culprit may be the mercury dispenser. Investigate all of the dispensers' seams for evidence of mercury. While holding the dispenser over the preparation area, gently tap the dispenser with a wooden pencil and watch for mercury falling from the dispenser and check the seams again for any mercury. Of course, repair or replace any dispenser that leaks.

It is especially important to remember to close the amalgam capsule immediately after removing the amalgam mass. The capsule contains a high concentration of vapors from the freshly mixed amalgam. If the capsule is left open, the vapors escape and contaminate the air we breathe.

Mercury and amalgam continually give off vapor. Mercury should be stored in unbreakable, tightly sealed containers. Scrap amalgam is stored under X-ray fixer, water or another recognized suppressant (e.g. Hgx, NSN 6850-00-495-5506) in a tightly closed plastic container.

The rules that have been set forth are there for your protection. If dental personnel follow the rules, contamination of the environment and especially of personnel is kept to minimum standards.

Exercises (044):

1. Mercury is in what state at room temperature and what causes it to change to a vapor?

2. What is the main potential hazard from mercury and how does it affect dental personnel?

3. List two ways mercury contamination can occur in the dental clinic.

4. What precautions should be taken when grinding or polishing amalgam?

5. Describe the type of receptacle used when preparing dental amalgam and explain why this type is used.

6. What, if any, advantage does precapsulated amalgam have over the minimal mercury technique of amalgam preparation?

7. How should mercury and scrap amalgam be stored?

045. Distinguish the hazards of transmitting infection and the steps to control microbial activity.

Infection. The prevention of infectious disease transmission is one of the most important duties of the dental assistant. It is vital that the dental treatment room be neat and clean as possible. All materials and instruments used during patient contact should be prepared and handled so that they do not transfer diseases. All objects touched or handled during patient treatment should be wiped with disinfectant after each patient visit.

Personal contact is a mode of infection transmission all dental personnel should be especially aware of. Infectious diseases such as tuberculosis, serum hepatitis, and venereal diseases may be present in the patients mouth. Cuts or any open areas on fingers or hands should be covered by either finger cots or rubber gloves while working on patients.

A hazard for the dental operator and the assistant is that of inhaling the mist of bacteria and debris that may be produced by high-speed handpieces with water sprays. Face masks offer you a degree of protection from transmission of diseases by droplets. Germs are spread as people breathe, cough, sneeze, or talk. Colds, flu, and tuberculosis are a few of the illnesses that may be prevented by wearing a face mask. It would be a good safety habit to wear a face mask anytime you are working around a patient.

Eye infections, or even loss of an eye, may be avoided by wearing safety glasses. Bacteria and viruses transmitted by droplets of moisture can enter into the eye in a number of ways. AFR 162-1 states the wearing of protective eyeglasses is a *must* for both patients and dental staff during patient treatment. Safety glasses also afford protection from projectiles or debris generated by scaling, cutting, or polishing procedures. If you do not have a pair of well-fitting safety glasses, it is your responsibility to procure a set. If you are unsure of the correct procedures to obtain safety glasses, see your supervisor for instructions.

Exercises (045):

1. What is one of the dental assistants most important duties and what should be accomplished after each patient visit?

2. What hazard for dental personnel may result from the use of high-speed handpieces with water sprays?

3. Why should face masks be worn and when should they be worn?

4. What type of infection deals with infective micro-organisms and give examples of such infections?

5. Under what conditions should safety glasses be worn and who should wear them?

046. Associate burns with the use of chemicals and equipment used in the dental clinic environment.

Burns. Burns, whether chemical or thermal, are injuries that can be avoided by exercising caution when working with caustic chemicals and equipment that produces high heat. When handling caustic chemicals, you should know what the antidote is and where it is located. Chemical burns of the eyes and skin can result from careless use of many materials such as etchant acids, radiographic solutions, endodontic materials and bleaching agents. Proper storage of chemicals is critical for safety. Consideration when designating areas used for storage of chemicals should include proximity to other chemicals, heat or open flame, type of container and cabinet. Equipment having the potential to cause thermal burns, such as sterilizers, should be located in an area convenient for use while minimizing the chance of accidental burns.

Exercises (046):

1. In reference to handling caustic chemicals, what should you know?

2. What considerations should be made when selecting areas used for storage of chemicals?

4-4. Accident Reporting

In spite of our best efforts to make the dental clinic a safe and healthful place in which to work, mishaps may occur. Fortunately, most mishaps are no more than minor annoyances. They cause no damage that cannot be quickly repaired, and injuries, if any, are usually slight. However, a mishap or injury of a more serious nature could happen. This section differentiates between reportable and nonreportable mishaps; and outlines your responsibilities, and those of your supervisors, in handling and reporting mishaps.

047. Differentiate between reportable and nonreportable mishaps.

Reportable/Nonreportable Mishaps. AFR 127-4, *Investigating and Reporting US Air Force Mishaps*, groups nonnuclear mishaps into four classes (A, B, C, and D) according to the total dollar cost and the extent of injuries involved. Any mishap involving Air Force personnel (on, or off duty) or equipment and costing $1000 or more to recover from, or resulting in death, dismemberment, unconsciousness, lost workdays, or transfer (even on a temporary basis) to another job as a result of injuries suffered, or that requires medical attention greater than first aid, is considered to be reportable under one of these classifications.

Exercises (047):

1. You have just burned your hand on a hot sterilizer. The burn is quite painful, and you go to the hospital emergency room for attention. While there, a physician looks at your burn, applies some ointment and gauze, and sends you back to work. Is this a reportable accident? Explain your answer.

2. You rent an Air Force fishing boat for the weekend. On the way home it breaks loose from your car, runs off the road, smashes into a farmer's fence (causing $300 damage), and destroys the boat and trailer (worth about $800). No one is injured. Is this is reportable mishap? Explain your answer.

048. Correlate mishap handling and reporting procedures.

Handling and Reporting Mishaps. The immediate removal of accident victims from hazardous situations and the rendering of emergency first aid are your first and most important considerations whenever you witness or are involved in a mishap. Your next most important concern is to limit the situation that produced the mishap. This is, of course, providing that you do so without unnecessarily exposing yourself and other personnel to danger. Otherwise, clear the area and call emergency personnel to the scene as quickly as possible.

Initial notification. Notify your supervisor and the supervisor of any injuried personnel quickly as possible after a mishap. Include the following information in your report:

a. Name, rank, Social Security number, and organization of all personnel directly involved.

b. Give a brief, general description of injuries sustained by personnel, including yourself, and their present location.

c. Briefly describe the damage done to facilities, vehicles, equipment, and materials.

Remain available to answer any questions or to provide additional information, as needed.

The formal report chain. Following your initial notification, your supervisor contacts his or her supervisor or unit commander, the unit safety officer or NCO, and the base emergency response agency, if necessary, provided this has not already been done. These agencies and personnel, according to the nature and severity of the mishap, may be required to contact additional agencies and personnel such as those shown in figure 4-1.

Mishap forms. According to the nature and severity of reportable mishaps, you, your supervisor, and all personnel concerned with the mishap may be called upon to fill out various forms concerning the mishap and your (their) involvement with it. These forms normally originate in base, wing, group, or unit safety offices. Your unit safety officer or NCO is always available to help you fill them out correctly.

Exercises (048):

1. What should be taken care of after mishap victims are removed from danger and given emergency first aid?

2. Who is the first person you should notify after a mishap is under control?

3. Is the drug and alcohol abuse control officer notified of every reportable mishap? Explain.

4. What kind of forms do you use for reporting mishaps, and where can you get them? How can you be sure to fill them out completely and correctly?

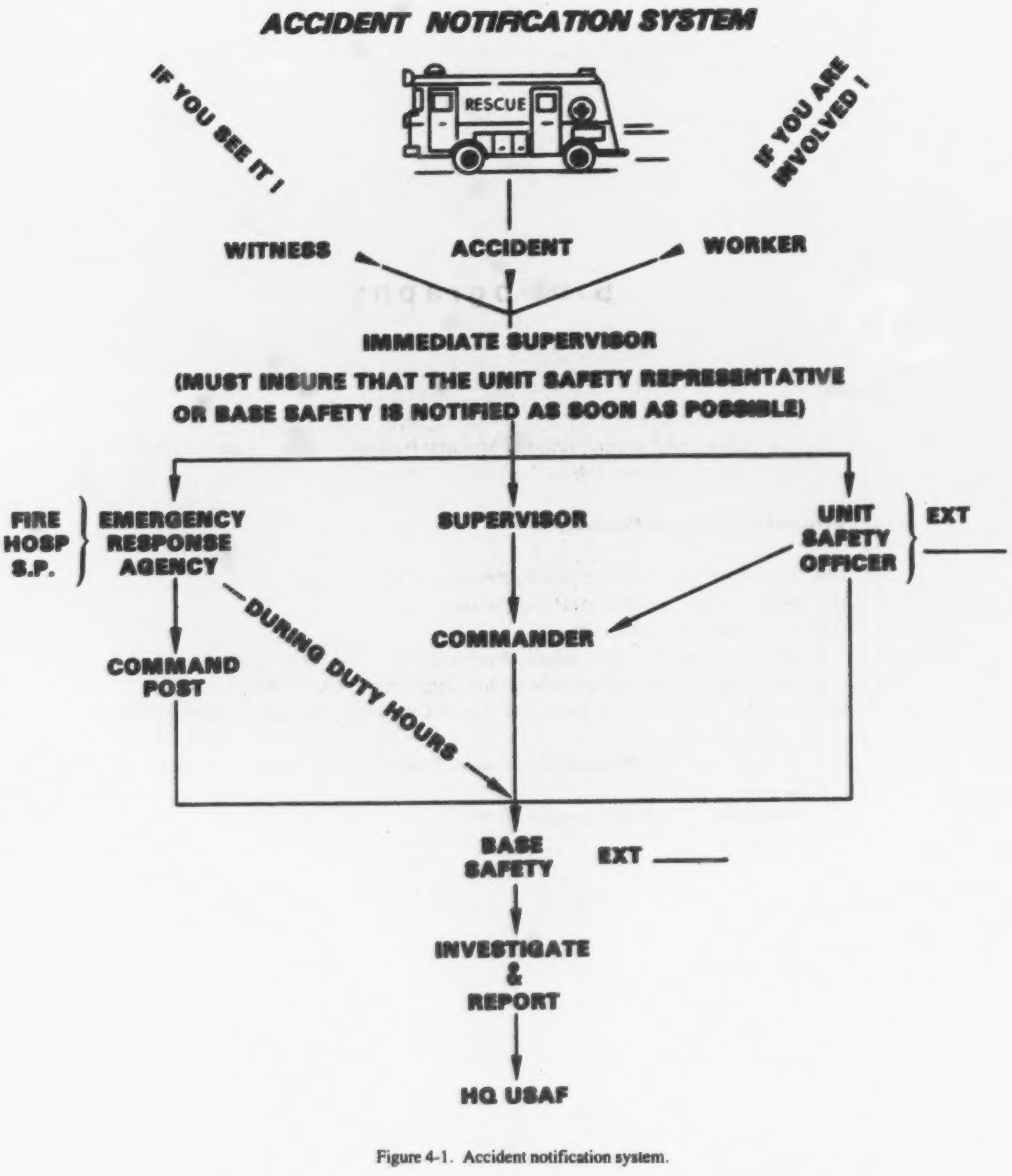
ACCIDENT NOTIFICATION SYSTEM
IF YOU SEE IT !
RESCUE
IF YOU ARE INVOLVED !
WITNESS
ACCIDENT
WORKER
IMMEDIATE SUPERVISOR
(MUST INSURE THAT THE UNIT SAFETY REPRESENTATIVE OR BASE SAFETY IS NOTIFIED AS SOON AS POSSIBLE)
FIRE
HOSP
S.P.
EMERGENCY RESPONSE AGENCY
SUPERVISOR
UNIT SAFETY OFFICER
EXT
DURING DUTY HOURS
COMMAND POST
COMMANDER
BASE SAFETY
EXT
INVESTIGATE & REPORT
HQ USAF

Figure 4-1. Accident notification system.

Bibliography

Books

Emergency Care and Transportation of Sick and Injured, 2nd ed., American Academy of Orthopedic Surgeons, 1981.

Department of Air Force Publications

AFR 28–3, *USAF Operation Planning Process (FOUO).*
AFR 39–1, *Airman Classification Regulation.*
AFR 55–30 *Operations Security.*
AFR 162–1, *Management and Administration of USAF Dental Activities.*
AFR 205–1, *Information Security Program (Supplements DOD 5200.1-R) (PA).*
AFM 160–12, *Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries.*
AFP 161–3, *NATO Handbook on the Medical Aspects of NBC Defensive Operations A MED P–6.*
AFOSH Standard 127–8, *Medical Facilities.*

Answers for Exercises

CHAPTER 1

Reference:
001 – 1. To provide medical support necessary to maintain the highest degree of combat readiness and effectiveness of the Air Force.
001 – 2. You are a medic assigned to the hospital.

002 – 1. Maintain the oral health of Air Force personnel and other uniformed service members to ensure their maximum wartime readiness and combat capability. Train to ensure competency in tasks required to support the overall medical mission in time of war or other contingency situations.
002 – 2. Provide, to the greatest extent possible, a peacetime oral health service for all eligible beneficiaries.
  (1) a.
  (2) b.
  (3) b.
  (4) b.
  (5) a.
  (6) a.
002 – 3. Restorative dentistry.

003 – 1. At the command headquarters installation.
003 – 2. The surgeon General.
003 – 3. Lieutenant General.
003 – 4. Director, Base Medical Services; Hospital Commander.

004 – 1.
  (1) b.
  (2) a.
  (3) d.
  (4) c.

005 – 1. Assistant Surgeon General for Dental Services.
005 – 2. The highest level of command.
005 – 3. Major General.
005 – 4. F. The Assistant Surgeon General for Dental Services holds the highest position within the dental field.
005 – 5. F. The enlisted advisor works for the enlisted force by providing advice to the Assistant Surgeon General for Dental Services.
005 – 6. F. The oral surgeon is responsible for performing oral surgical procedures, while the base dental surgeon is responsible for overall operation of the dental facility.
005 – 7. T.

006 – 1. Reporting supervisor (reporting official).
006 – 2. The NCOIC.
006 – 3. The NCOIC.
006 – 4. T.
006 – 5. F. Your NCOIC is responsible for allowing time off.
006 – 6. F. All time off must be coordinated with your NCOIC.
006 – 7. T.

007 – 1. (1) e.
  (2) c.
  (3) a.
  (4) e.
  (5) b.
  (6) a.
  (7) d.
007 – 2. a. Administrative assistant to the base dental surgeon.
  b. Supervisor of enlisted personnel and at smaller clinics administrative assistant to the base dental surgeon.
  c. Minor equipment maintenance, knowledge center, precious metal recovery center, coordinates testing of autoclaves, and orders and issues supplies.
  d. Answers incoming calls, records management, routes patients, and determines patient eligibility.

008 – 1. T.
008 – 2. F. The Confederate Army of the South first conscripted dentists.
008 – 3. T.
008 – 4. F. They have never separated.
008 – 5. F. Great Lakes Naval Training Center taught the first Air Force dental specialists.
008 – 6. (1) d.
  (2) f.
  (3) a.
  (4) b.
  (5) e.
  (6) g.
  (7) c.
  (8) h.

009 – 1. Hospital Commander (Director, Base Medical Services).
009 – 2. Either the director, Base Medical Services, or the Hospital administrative officer.
009 – 3. Military image and role fulfillment.
009 – 4. For efficient and proper management of a medical facility.
009 – 5. A Medical Service Corp (MSC) officer; either a physician or a Medical Service Corps officer.
009 – 6. Patient treatment and physical facilities.
009 – 7. Director, Base Medical Services.
009 – 8. Medical Service Corps.

CHAPTER 2

010 – 1. Apprentice Dental Specialist, 98130.
010 – 2. 98170.
010 – 3. Dental manager.

011 – 1. AFR 39–1.
011 – 2. Depth of knowledge and degree of proficiency.
011 – 3. There is some overlap with the 5 level; but the 7 level is more involved with management, supervision, and oral hygiene duties.
011 – 4. 98190 and 98100.
011 – 5. (1) d, e.
  (2) b.
  (3) a, b, c, d, e.
  (4) d, e.
  (5) c, d, e.

012 – 1. (1) c.
  (2) c.
  (3) a.
  (4) d, e.
  (5) d, e.
  (6) c.
  (7) a.
  (8) c.
  (9) b, c.
  (10) b, c.

CHAPTER 3

013 – 1. To maximize the effectiveness of personnel and resources during a mass casualty situation.
013 – 2. Base Disaster Preparedness Operations Plan.
013 – 3. F.
013 – 4. Base commander.
013 – 5. To assign responsibility for management of disaster situations to appropriate units and personnel.

014 – 1. To provide guidance to medical personnel regarding preparations for and operations during a peacetime disaster.
014 – 2. All medical personnel.
014 – 3. Annexes.
014 – 4. All medical facilities.
014 – 5. Peacetime.

015 – 1. Provide guidance during wartime casualty situations.
015 – 2. DCCP is guidance for a peacetime disaster, and the CSP gives guidance during a wartime situation.
015 – 3. Annexes.
015 – 4. Annually.

016 – 1. (1) To provide actual physical security to those items that make up the Air Force combat capability, and (2) to safeguard classified information and material.
016 – 2. Patient medical/dental records and sedated patients.
016 – 3. To enhance mission effectiveness by contributing toward the maintenance of an optimum level of overall security for all Air Force operations.

017 – 1. Environmental health section.
017 – 2. Each individual is responsible for his or her own mess kit; to prevent serious illness to the user.
017 – 3. By keeping the living area clean, free of waste materials, and free of clutter.
017 – 4. A ditch used for a latrine.
017 – 5. With the word POTABLE marked on the outside of the water container.

018 – 1. To move an unconscious patient. It should not be used for patients who have spinal cord or neck injuries.
018 – 2. It cannot be used on patients with fractures of the extremities.
018 – 3. Four-hand carry. The patient must be conscious to aid in self support.
018 – 4. Bearers 1, 2, and 3 are on the patient's injured side. Steadies the litter and gives the lifting command.
018 – 5. When going up steep inclines.

019 – 1. Head first.
019 – 2. Four.
019 – 3. Bumping the patient's head on the crossmembers of the tracks.
019 – 4. Top berths.

020 – 1. (1) g.
(2) e.
(3) a.
(4) h.
(5) c.
(6) d.
(7) b.
(8) f.
020 – 2. Secure and maintain a clear airway and give oxygen as needed.
020 – 3. In general, keep the patient supine.

021 – 1. Blood from an artery spurts and is bright red. Blood from a vein generally comes in a slow and steady flow and its color is much darker. Bleeding from capillaries is a continuous steady ooze.
021 – 2. By applying local pressure.
021 – 3. It depends upon the location of the bleeding site and the cause of the hemorrhage.

022 – 1. A closed wound is one in which soft tissue damage occurs beneath the skin but in which there is no break in the surface.
022 – 2. An open wound is one in which there is a break in the surface of the skin or in the mucous membrane that lines the major body orifices.
022 – 3. Splinting is a first priority. To achieve control of the bone injury and minimize soft tissue damage.
022 – 4. (1) d.
(2) b.
(3) c.
(4) a.
022 – 5. Control the bleeding, prevent further contamination, and immobilize the part and keep the patient quiet.

023 – 1. (1) b.
(2) e.
(3) a.
(4) c.
(5) d.
023 – 2. Any fracture in which the overlying skin has been lacerated.
023 – 3. A closed fracture is when the skin has not been penetrated by the bone ends and no wound exists near the fracture.
023 – 4. After the injured patient's vital functions are assessed and stabilized.
023 – 5. Splinting prevents the motion of fracture fragments or of a soft tissue injury, thus reducing pain.
023 – 6. Splint.

024 – 1. In terms of damage to the skin.
024 – 2 Thermal.
024 – 3. This rule applies specifically to adults and older children, divides the body into sections, each of which constitutes approximately 9 percent of the total body surface area.
024 – 4. Immerse the burned part in cold water for 2 to 5 minutes if the patient is seen within 15 minutes of the time of injury and the burn involves less than 20 percent of the total body surface. Cover the burn with a dry, sterile dressing or clean sheet and transport the patient promptly to an emergency treatment facility.
024 – 5. As acids or alkalis.
024 – 6. Generally the entrance wound is small, but the electric current characteristically destroys a considerable volume of tissue underneath what is an apparently small skin wound.
024 – 7. Nuclear radiation and solar radiation.
024 – 8. (1) Heat cramps which are painful muscle spasms; (2) heat exhaustion is heat prostration or heat collaspe; and (3) heatstroke is when the body's mechanisms for dissipating excess heat are overwhelmed.

025 – 1. (1) e.
(2) d.
(3) c.
(4) b.
(5) a.
025 – 2. The deviation of the exposure, the temperature to which the skin was exposed, and the wind velocity or speed.
025 – 3. Firm steady pressure from a warm hand, blowing hot breath, or holding frostnipped fingers against the body.
025 – 4. The patient should be taken out of the cold and the area carefully, slowly rewarmed.
025 – 5. These patients should be transported to an emergency treatment facility. Treatment is immediate rewarming.

026 – 1. Monitoring of radiation levels, decontamination of personnel, sorting of casualties, and treatment of casualties.
026 – 2. Predesignated shelter areas.
026 – 3. Move to a prepared site or location considered safer.
026 – 4. Preventive medicine.

027 – 1. Radiation poisoning, burns, and all types of wounds.
027 – 2. At ground zero.

028 – 1. Identification is difficult and slow, delayed action, can spread from individual to individual, limited by its ability to survive.
028 – 2. Cannot be detected by the unaided senses.
028 – 3. Air, light, heat, cold, dryness.

029 – 1. Good personal hygiene.
029 – 2. Through abrasions of the skin, mucous membranes of the respiratory system, gastrointestinal and genitourinary tracts, and eyes.

029 – 3. Removal of all contaminated clothing and complete cleansing of the body.

030 – 1. Skin, eyes, and nervous system.
030 – 2. Mild headaches, coughing, blurred vision, laryngeal spasm, convulsions, and coma.
030 – 3. Cleansing and dressing of blisters, and eye irrigation.
030 – 4. Through the use of artificial respiration and intramuscular atropine.
030 – 5. By wearing protective masks, gloves and clothing.

031 – 1. (1) b.
  (2) e.
  (3) c.
  (4) d.
  (5) a.
  (6) f.
  (7) b.
  (8) d.
  (9) c.
  (10) e.

032 – 1. It consists of two pieces, coat and trousers.
032 – 2. Two pairs (4 total).
032 – 3. Five years.
032 – 4. Physiological heat burden, not POL resistant, not flame resistant, no gamma radiation protection, replacements are required, has static electric charge/discharge potential.
032 – 5. Outer garments are nylon and treated cotton with charcoal impregnated polyurethane foam, cotton gloves and butyl rubber gloves, boots of butyl rubber, mask and hood.

033 – 1. (1) Establishing airways and stabilizing respiration; (2) controlling hemorrhage; (3) caring for minor injuries so the patient can return to duty (including emergency dental treatment necessary to return the patient to duty); and (4) preparing for the evacuation of those patients requiring treatment at the next echelon of care.
033 – 2. To meet the needs of the medical readiness mission.
033 – 3. (1) Platform/chair, (2) light, (3) vacuum system, and (4) operating unit.

CHAPTER 4

034 – 1. Air Force Occupational Safety and Health.
034 – 2. Unit commanders, functional managers, and supervisors.
034 – 3. At least once a year, high-hazard work places at least twice a year.

035 – 1. Formal technical course or your supervisor in on-the-job training.
035 – 2. Know your equipment and how to operate it safely.
035 – 3. Read the operating instructions.

036 – 1. Self-discipline.
036 – 2. You.

037 – 1. F. It's a prime prerequisite in avoiding accidents.
037 – 2. T.

038 – 1. (1) d.
  (2) a.
  (3) a.
  (4) c.
  (5) b.
  (6) a.
  (7) b.
  (8) d.

039 – 1. F. Impaired mental and physical fitness can cause accidents.
039 – 2. T.
039 – 3. T.

040 – 1. Practice proper handling procedures and take necessary precautions.
040 – 2. Make maximum use of proper operational procedures.
040 – 3. Control flame sources such as torches and burners; do not use flammable materials around fire or heat sources; and, ensure all gas hoses, valves, etc., are gas-tight and in good working order.

041 – 1. F. A dull cutting edge is more likely to slip and cause injury.
041 – 2. T.

042 – 1. (1) c.
  (2) a.
  (3) a.
  (4) b.
  (5) b.

043 – 1. Check pertinent safety instructions.
043 – 2. Materials you work with, protective clothing, or type of equipment that you use.

044 – 1. Liquid; heat.
044 – 2. Vapor; mercury toxication.
044 – 3. Noticeable gross spills; small leaks or spills that go unobserved.
044 – 4. Avoid heat buildup by use of water spray as a coolant/flush, while simultaneously providing evacuation with the high volume evacuator.
044 – 5. One that is impervious to mercury, large lipped tray or cabinet well. To contain any spillage.
044 – 6. Chance of mercury spill is virtually eliminated and vapors are reduced during trituration.
044 – 7. Stored in unbreakable, tightly sealed containers, under X-ray fixer, water or another recognized suppressant in a tightly closed plastic container.

045 – 1. Prevention of infectious disease transmission; all objects touched or handled during patient treatment should be wiped with disinfectant.
045 – 2. Inhaling the mist of bacteria and debris.
045 – 3. To provide a degree of protection from transmission of diseases by droplet infection; any time you are working around a patient.
045 – 4. Personal contact; tuberculosis, serum hepatitis and venereal diseases.
045 – 5. During patient treatment; both patients and dental staff.

046 – 1. What the antidote is and where it is located.
046 – 2. Proximity to other chemicals, heat or open flame, type of container, and cabinet.
047 – 1. No. The accident did not result in death, dismemberment, unconsciousness, lost workdays, transfer to another job, or required medical attention greater than first aid.
047 – 2. Yes. The accident involved Air Force personnel off duty and an equipment recovery cost of $1000 or more.

048 – 1. Help contain the situation that caused the mishap.
048 – 2. Your supervisor and the supervisor of any injured personnel.
048 – 3. No. They are not in the formal report chain.
048 – 4. Mishap forms; base, wing, group or unit safety offices. Consult your unit safety officer or NCO.

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STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

98150 01 26

INTRODUCTION TO DENTAL SERVICE

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (001) Which of the following statements *best* describes the mission of the Air Force Medical Service?

   a. To provide treatment to those in need of medical care.
   b. To provide support to maintain the highest degree of combat readiness and effectiveness of Air Force.
   c. To provide medical care for USAF and NATO personnel as needed in combat situations.
   d. To provide treatment for all US armed forces to maintain a high degree of combat readiness.

2. (002) Which of the following sections is essentially responsible for treatment of dental conditions to prevent and reduce manpower losses?

   a. Restorative.
   b. Endodontic.
   c. Prosthodontic.
   d. Oral surgery.

3. (002) What tasks must be learned to obtain the WARSKIL Air Force Speciality Code (AFSC)?

   a. Basic dental.
   b. Advanced dental.
   c. Basic medical.
   d. Advanced medical.

4. (002) The USAF Preventive Dentistry Program is divided into how many phases?

   a. 2.
   b. 3.
   c. 4.
   d. 5.

5. (002) Which of the following sections is included in the clinical professional services?

   a. Radiographic.
   b. Dental supply.
   c. Records/Reception.
   d. Clinical management.

6. (003) The individual in charge at the echelon beneath the Command Surgeon is the

   a. Hospital Commander.
   b. Surgeon General.
   c. Base Dental Surgeon.
   d. Director, Base Medical Services.

7. (003) Which of the following positions may a Medical Service Corps officer hold?

   a. Surgeon General.
   b. Command Dental Surgeon.
   c. Dental Surgeon.
   d. Director, Base Medical Services.

8. (004) Which medical facility usually has no beds?

   a. Clinics.
   b. Hospitals.
   c. Regional hospitals.
   d. Medical centers.

9. (004) Of the following medical facilities, which normally furnishes treatment in all major medical specialties?

   a. Clinics.
   b. Hospitals.
   c. Regional hospitals.
   d. Medical centers.

10. (005) What is the title of the *highest* position within the Dental Corps?

    a. Surgeon General.
    b. Command Dental Surgeon.
    c. Assistant Surgeon General for Dental Services.
    d. Advisor to Assistant Surgeon General for Dental Services for Enlisted Affairs.

11. (005) What is the title of the dental officer in charge of dental facilities at a medical center?

a. Director, Base Dental Services.
b. Director, Dental Services.
c. Base Dental Surgeon.
d. Command Dental Surgeon.

12. (006) Which supervisor is responsible for accomplishing your performance report?

a. Clinic NCOIC.
b. Reporting official.
c. Dental supervisor.
d. Dentist with whom you work.

13. (006) Who monitors the quality of your work and ensures that you are trained in areas of deficiency?

a. Clinic NCOIC.
b. Reporting official.
c. Dental supervisor.
d. Dentist with whom you work.

14. (007) Which section is responsible for liaison between the dental clinic and repair units?

a. Dental supply.
b. Administrative.
c. Records/Reception.
d. Clinical management.

15. (007) Which of the following sections is staffed by personnel holding AFSC 982X0?

a. Front desk.
b. Dental supply.
c. Dental laboratory.
d. Dental superintendent.

16. (008) In what year was the Army and Air Force medical departments separated?

a. 1917.
b. 1945.
c. 1949.
d. 1951.

17. (008) Between the years 1950 and 1955, where did dental specialists receive their basic dental training?

a. Great Lakes Naval Training Center.
b. Gunter AFS.
c. Sheppard AFB.
d. School of Aviation Medicine.

18. (009) Who is ultimately responsible for patient treatment and base medical physical facilities?

a. Hospital Commander.
b. Administrative Officer.
c. Squadron Commander.
d. Base Dental Surgeon.

19. (009) The squadron commander of a medical unit belongs to which corps?

a. Dental.
b. Hospital.
c. Medical.
d. Medical service.

20. (010) Before you can receive your 5 skill level, you must complete CDC and OJT requirements and be recommended by your

a. training supervisor and Base Dental Surgeon.
b. commander and Base Dental surgeon.
c. commander and training supervisor.
d. training supervisor and dental superintendent.

21. (010) Which of the following *must* you complete to obtain the 7 skill level?

a. Career development course and professional military education.
b. Job proficiency training and professional military education.
c. Job proficiency training and dental technician course.
d. Career development course and job proficiency training.

22. (011) Which regulation contains a summary of the more important duties of a dental airman?

a. AFR 162-421.
b. AFR 162-1.
c. AFR 39-1.
d. AFR 0-2.

23. (011) Which AFSC is *most* involved in management and supervision and oral hygiene duties?

a. 98150.
b. 98170.
c. 98190.
d. 98100.

24. (012) Which AFSC will spend the *most* time assisting in the restorative dentistry section?

a. 98150.
b. 98170.
c. 98190.
d. 98100 CEM.

25. (012) Which AFSC would a working manager *most* likely hold?

a. 98100 CEM.
b. 98150.
c. 98170.
d. 98190.

26. (013) Which of the following specifically assigns responsibility for management of disaster situations to appropriate units and personnel?

a. Annexes.
b. Base OPLAN.
c. Contingency Support Plan.
d. Disaster Casualty Control Plan.

27. (013) What alphabetic letter designates the medical annex of the Base OPLAN?

a. C.
b. F.
c. L.
d. M.

28. (014) Which medical facilities *must* have a Disaster Casualty Control Plan?

a. Clinics and hospitals only.
b. Hospitals and regional hospitals only.
c. Medical centers and regional hospitals only.
d. All medical facilities.

29. (014) Which of the following provides simple guidance concerning specific tasks and responsibilities during a disaster?

a. Annex A.
b. Base OPLAN.
c. Contingency Support Plan.
d. Disaster Casualty Control Plan.

30. (015) The Contingency Support Plan is *best* described as a plan which gives

a. specific guidance for simple tasks during wartime disaster situations.
b. simple guidance for specific tasks during wartime disaster situations.
c. specific guidance for simple tasks during peacetime disaster situations.
d. simple guidance for specific tasks during peacetime disaster situations.

31. (015) How often must medical personnel be trained in the concept of operations of the Contingency Support Plan?

a. Monthly.
b. Quarterly.
c. Semiannually.
d. Annually.

32. (016) As a dental assistant, which of the following Air Force security programs has the *most* direct bearing on you?

a. Providing actual physical security to those items that make up the Air Force combat capability.
b. Safeguarding of classified information.
c. Training in the concept of the contingency support plan.
d. Participating in the disaster casualty control plan.

33. (016) When performing your duties as a dental assistant, you can be exposed to classified information from

a. a patient's medical record.
b. a patient's dental record.
c. a sedated patient.
d. all of the above.

34. (016) Which program is designed to enhance mission effectiveness by contributing toward the maintenance of an optimum level of overall security for all Air Force Operations?

a. Disaster Casualty Control Plan (DCCP).
b. Commuications Security (COMSEC).
c. Operations Security (OPSEC).
d. Contingency Support Plan (CSP).

35. (017) How are field containers of drinking water identified?

a. They are marked "LYSTER BAG."
b. They have outlets for filling cups and canteens.
c. They are marked "POTABLE."
d. They are located only in the medical facility.

36. (017) How *must* garbage and rubbish be disposed of in a field environment?

a. Bagged in plastic bags.
b. Burned in a sanitary landfill.
c. Bagged and burned in a landfill.
d. Burned in an incinerator.

37. (018) Which type of carry is *best* used for a patient who is conscious, has a broken arm and leg, and must be transported a considerable distance?

a. Four-hand carry.
b. Fireman's carry.
c. Two-man arm carry.
d. One- and two-man supporting carry.

38. (018) Litter patients are transported up steep inclines by

a. using a litter and transporting feet first.
b. using a litter and transporting head first.
c. removing the patient from the litter and transporting in a wheelchair.
d. removing the patient from the litter and transporting by an approved type of patient hand carry.

39. (019) How many litter bearers are required to load and unload an ambulance litter patient?

a. 2.
b. 4.
c. 5.
d. 6.

40. (019) Which berths of an ambulance should be loaded *first*?

a. Top.
b. Bottom.
c. Drivers side.
d. Passenger side.

41. (020) What is the *first* principle of initial treatment that applies to all patients in shock?

a. Control all obvious bleeding.
b. Secure and maintain a clear airway.
c. Elevate the lower extremities.
d. Avoid rough and excessive handling of the patient.

42. Which of the following types of shock is caused by an allergic reaction?

a. Anaphylactic.
b. Psychogenic.
c. Neurogenic.
d. Metabolic.

43. (021) How much blood loss in an adult is considered very dangerous?

a. 1/2 pint.
b. 1 pint.
c. 1/2 litter.
d. 1 liter.

44. (021) Which of the following characteristics does blood escaping from an artery exhibit?

a. A steady flow and is dark red.
b. In spurts and is bright red.
c. A slow and steady flow.
d. A continuous steady ooze.

45. (022) What is the *most* severe closed soft tissue injury?

a. Bruise.
b. Contusion.
c. Ecchymoses.
d. Hematoma.

46. (022) What type of soft tissue wound is characterized by a whole piece of skin with varying portions of subcutaneous tissue or muscle either torn loose completely or left hanging as a flap?

a. Abrasion.
b. Laceration.
c. Avulsion.
d. Puncture wound.

47. (023) What type of fracture occurs when the bone is broken into more than two fragments?

a. Comminuted.
b. Greenstick.
c. Stress.
d. Pathologic.

48. (023) A fracture that occurs when the bone is subjected to frequent, repeated stresses is called

a. pathologic.
b. stress or fatigue.
c. greenstick.
d. epiphyseal.

49. (024) What degree of burn causes damage into, but not through the dermis, and characteristically results in the appearance of blisters in the skin?

a. First.
b. Second.
c. Third.
d. Fourth.

50. (024) When should grease be applied to a thermal burn?

   a. In the case of first-degree burns.
   b. In the case of second-degree burns.
   c. In the case of third-degree burns.
   d. Never.

51. (024) Generally speaking, what type of chemical burns are more serious because they penetrate deeper and cause more severe injury?

   a. Alkali.
   b. Acids.
   c. Radiant energy.
   d. Systemic reactions to heat.

52. (024) First attention to the patient with an electrical burn must be directed to

   a. local care of the burn.
   b. treatment for shock.
   c. cardiopulmonary resuscitation.
   d. keeping the patient covered and dry.

53. (025) The direct transfer of heat by contact from the body to a colder object is

   a. conduction.
   b. convection.
   c. evaporation.
   d. radiation.

54. (025) Loss of body heat through convection occurs

   a. when warm air from the lungs is exhaled into the cold atmosphere.
   b. with the direct transfer of heat by contact from the body to a colder object.
   c. when heat is transferred through air moving across the body surface to a cooler environment.
   d. with the loss of heat from the body in still air.

55. (026) Which of the following is a medical function after a nuclear attack?

   a. Monitor radiation levels.
   b. Move to shelter areas.
   c. Move the medical mission to a predesignated site.
   d. Treatment of personnel with high mortality probability.

56. (026) With sufficient warning, which of the following can be done with medical resources if the medical facility is *not* a designated shelter area?

   a. Cover and try to protect from fallout.
   b. Try to protect the resources from the blast.
   c. Move to a prepared site or location considered safer than the medical facility.
   d. Have preventive medicine teams take precautions to prevent epidemics.

57. (027) If you are in a conventional structure, what percentage *best* indicates the chances of survival at ground zero of a nuclear blast?

   a. 0 percent.
   b. 33 percent.
   c. 50 percent.
   d. 75 percent.

58. (027) As distance from ground zero increases, the casualties will

   a. increase.
   b. decrease.
   c. receive increased radiation poisoning.
   d. receive more severe blast wounds.

59. (028) Which of the following *best* describes identification of biological agents?

a. Can usually be easily identified with sophisticated equipment.
b. Can be quickly identified once the human senses have detected them.
c. Difficult and slow to identify.
d. Can be identified by its dissemination method.

60. (028) What limits a biological agent's ability to survive?

a. Number of days since dissemination.
b. Availability of hosts.
c. Positive identification.
d. Environment.

61. (029) Which of the following is a principle portal of entry for a biological agent?

a. Ear.
b. Scalp.
c. Eyes.
d. Palms of hands.

62. (029) Which of the following is an example of basic treatment for biological agent contamination?

a. Atropine injection.
b. Use of protective mask.
c. Removal of contaminated clothing and cleansing the body.
d. Oxygen therapy.

63. (030) How should an airway be cleared of possible chemical contamination?

a. Forced deep breathing.
b. Oxygen therapy.
c. Coughing.
d. Frequent spitting.

64. (031) Which of the following describes the triage term "delayed"?

a. Treatment is to be delayed because patient is going to die.
b. Treatment has to be delayed until transported to a surgical unit.
c. Injuries are so slight that treatment by a physician is not necessary.
d. Injuries do not jeopardize life if treatment is delayed.

65. (031) A blue colored triage tag indicates which of the following categories?

a. Minimal.
b. Expectant.
c. Delayed.
d. Immediate.

66. (032) During which warfare situation is the ground crew ensemble worn?

a. Chemical.
b. Biological.
c. Nuclear.
d. Conventional.

67. (032) What is the shelf life of the ground crew ensemble?

a. 1 year.
b. 3 years.
c. 5 years.
d. Indefinite.

68. (033) The USAF Minor Surgery Field Assembly was developed

a. to insure dental health in wartime.
b. to use dentists during wartime conditions.
c. to meet the needs of the Medical Readiness mission.
d. to add a dental clinic to the field hospital.

69. (033) Which of the following is *not* a concept of operation of the USAF Minor Surgery Field Assembly?

a. Establish airways and stabilize respiration.
b. Control hemorrhage.
c. Prepare for evacuation those patients requiring treatment at the next echelon of care.
d. Perform oral surgery procedures under field conditions.

70. (034) Which office has primary responsibility for the safety aspect of AFOSH?

a. Surgeon General.
b. Inspector General.
c. Unit commander.
d. Functional manager.

71. (034) How often do wing, group, and installation authorities conduct occupational safety, health, fire, and accident surveys and inspections?

a. Weekly.
b. Monthly.
c. Quarterly.
d. Yearly.

72. (035) The *first* principle of safety demands that

a. you wear protective clothing.
b. your supervisor has operated the equipment first.
c. your work area is properly lighted.
d. you know your equipment and how to operate it safely.

73. (036) The second major principle of safety is

a. discipline.
b. alertness.
c. preoperational checks.
d. avoiding unsafe practices.

74. (036) In accordance with the general safety principle of discipline, the person having the primary responsibility to safety check equipment in your work area is

a. you.
b. your supervisor.
c. the Ground Safety Officer.
d. the Medical Equipment Repair NCO.

75. (037) One of the major principles of safety is

a. initiative.
b. awareness.
c. intelligence.
d. alertness.

76. (037) The principal enemy of alertness is

a. drugs.
b. talking.
c. distractions.
d. poor lighting.

77. (038) When lifting heavy objects, the main point to remember is

a. to bend your back.
b. to stand up straight and lift with your legs.
c. to lift an object fast to avoid strain.
d. to keep your back straight and lift with your legs.

78. (038) Which action listed below is *not* a safety practice?

a. Use tools or instruments only for their designed purpose.
b. Lift with your back, not with your arms or legs.
c. Work at a moderate and consistent pace.
d. When using a knife, cut away from yourself.

79. (039) Which statement concerning the general safety principle of mental and physical fitness is correct?

   a. Mental fitness should be approached in a similar manner to physical fitness.
   b. Physical exercise programs normally have no effect on accident reduction.
   c. Mental worries are unrelated to alertness and accidents.
   d. Sight or hearing difficulties rarely cause accidents.

80. (039) Which of the following statements *best* describes mental fitness?

   a. Maintaining mental fitness is a complex process.
   b. Mental fitness is totally different from physical fitness.
   c. Little has been written concerning mental fitness.
   d. Mental fitness is of little concern to job safety.

81. (040) Most obvious dental equipment hazards can be dealt with by making maximum use of

   a. proper operational instructions.
   b. protective lubricants.
   c. safety glasses.
   d. gloves.

82. (040) Which of the following is *not* necessary in order for the chemical reaction of combustion to take place?

   a. Fuel.
   b. Oxygen.
   c. Heat.
   d. Wind.

83. (041) Which of the following general safety principles is *incorrectly* stated as it concerns proper equipment maintenance?

   a. A defective electric switch is hazardous even if it works.
   b. Any machine not in good condition constitutes a safety hazard.
   c. Worn or loose parts and parts out of adjustment are all hazardous.
   d. The cutting edge of tools should be kept dull or semisharp to avoid serious accidents.

84. (041) Which of the following is a *primary* rule concerning electronically operated machines?

   a. Machines should be positioned on wood or rubber bases.
   b. Switches should be in good condition.
   c. Cords should be two-wire.
   d. Cords should be at least 6 feet long.

85. (042) Maintaining a safety-oriented environment includes

   a. keeping floor and countertops free of oil, chemicals, or other debris.
   b. keeping hand instruments or equipment clean, properly stored, and in good working order.
   c. positioning equipment to allow for sufficient working space.
   d. all of the above.

86. (042) Positioning equipment so you will have sufficient working space to handle your materials is referred to as

   a. good housekeeping.
   b. layout of equipment.
   c. an undersirable condition.
   d. environmental safety.

87. (043) The amount of safety preoperational planning that should precede the beginning of your operations depends upon the

   a. nature of the tasks to be accomplished.
   b. amount of supervision available.
   c. attitude of your supervisory personnel.
   d. number of regulatory publications imposed upon you.

88. (043) The *most* important fact to bear in mind when planning to start a job is to check

a. with your supervisor first.
b. the power source of the equipment.
c. your ability to operate the equipment.
d. any pertinent safety instructions.

89. (044) While the dentist is grinding or polishing an amalgam restoration, you *must* provide

a. air spray and high volume evacuation.
b. water spray and high volume evacuation.
c. air and water spray.
d. water spray and saliva ejector.

90. (044) How should mercury be stored?

a. Under X-ray fixer.
b. Under water.
c. In amber colored glass bottles.
d. In unbreakable, tightly sealed containers.

91. (044) How should scrap amalgam be stored?

a. In a refrigerator in a plastic bottle.
b. Under 70 percent alcohol in an amber colored plastic container.
c. Under X-ray fixer or water in a tightly closed plastic container.
d. In amber colored glass bottles out of direct sunlight.

92. (045) When should all objects touched or handled during patient treatment be wiped with disinfectant?

a. At the beginning of each duty day.
b. At the end of each duty day.
c. After each patient visit.
d. Twice each duty day.

93. (045) What offers you protection from transmission of diseases by droplets?

a. Continual awareness.
b. Face mask.
c. Safety glasses.
d. Gloves.

94. (045) Under what conditions should you wear safety glasses?

a. When the dentist is using high speed drills.
b. During subgingival scaling procedures.
c. During patient treatment.
d. All of the above.

95. (046) When working with caustic chemicals, you should know the

a. manufacturer's location.
b. shelf-life of the substance.
c. stock list number.
d. antidote.

96. (046) Which of the following is *not* a consideration when designating areas used for storage of chemicals?

a. Proximity to other chemicals.
b. Proximity to heat.
c. Type of container or cabinet.
d. Equipment in which chemicals will be used.

97. (047) Nonnuclear mishaps are classed according to the

a. total dollar cost only.
b. extent of the injury only.
c. personnel involved and location of the mishap.
d. extent of the injury and total dollar cost involved.

98. (047) Which of the following would *not* be considered cause for a reportable mishap?

a. An Air Force member breaks a leg off duty.
b. A civilian on base is involved in an automobile accident.
c. A military truck is damaged with repair costs estimated at $500.00.
d. A military member is admitted to the hospital as the result of a fall at their private residence.

99. (048) What are your *first* and *most* important considerations whenever you witness or are involved in a mishap?

a. Clear the area as quickly as possible.
b. Call emergency personnel to the scene.
c. Contain the situation that caused the mishap.
d. Remove the victims from hazardous situations and render emergency aid.

100. (048) Who should you consult to correctly complete an accident report?

a. Unit safety officer/NCO.
b. Accident victim's supervisor.
c. Your supervisor.
d. Accident victim.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012 and EO 9397. **PRINCIPAL PURPOSES:** To provide student assistance as requested by individual students. **ROUTINE USES:** This form is shipped with ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. **DISCLOSURE:** Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance to the student.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: *(Mail to: ECI, Gunter AFS AL 36118)*

1. THIS REQUEST CONCERNS COURSE (1 - 6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER

5. SOCIAL SECURITY NUMBER (7 - 15) ☐☐☐ - ☐☐ - ☐☐☐☐	6. GRADE/RANK	7. NAME *(First initial, second initial, last name)* (17) (18) (19-32)

8. ADDRESS *(OJT Enrollees -- Address of unit training office with zip code. All others -- current mailing address with zip code.)*
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9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE

10. TEST CONTROL OFFICE ZIP CODE/SHRED (33 - 39)

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(Place an 'X' through number in box to left of service requested)

1	Request address change as indicated in Section I.
2	Request Test Control Office change as indicated in Section I.
3	Request name change/correction (Provide Old or Incorrect data)
4	Request Grade/Rank change/correction.
5	Correct SSAN. (List incorrect SSAN here) (Correct SSAN should be shown in Section I)
6	Extend course completion date. (Justify in REMARKS)
7	Request enrollment cancellation.
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. (Specify in REMARKS) ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on ______________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 not yet received. Answer sheet(s) submitted ________________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on ______________ (date).
13	Previous inquiry (☐ ECI Fm 17, ☐ Ltr, ☐ Msg) sent to ECI on ______________ (date).
14	Give instructional assistance as requested on reverse.
15	Other (Explain fully in REMARKS)

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3	39 - 42
16	

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OJT STUDENTS must have their OJT Administrator certify this request.	I certify that the information on this form is accurate and that this request cannot be answered at this station. *(Signature)*
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NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

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Has VRE Answer Sheet been submitted for grading?

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DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

Volume 2

Basic Sciences

UNITED STATES AIR FORCE
DA
CARING
KNOWLEDGE
PROFESSIONALISM
DENTAL ASSISTANT SPECIALIST

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Preface

THIS SECOND volume of CDC 98150, *Dental Assistant Specialist*, presents the basic dental sciences that are of concern to your job proficiency. These knowledges are beneficial in several ways. For example, they allow you to communicate with the dental officers in the terminology native to your vocation; they enable you to present a more professional image to the patients; and they allow you to perform better in your job because they have given you the background knowledge you need to understand your job. As in other volumes of this CDC, we review the material necessary to prepare you for your promotion testing (SKT), and we present new information to advance your knowledge in dental technology.

Chapter 1 presents a comprehensive study of anatomy and physiology of cells and tissues, body systems, elementary chemistry, and basic microbiology, sterilization, and disinfection. Chapter 2 is concerned with dental anatomy, physiology, and histology. Chapter 3 covers oral pathology from dental plaque to oral manifistations of systemic disorders. Chapter 4 presents the various dental materials you are likely to come in contact with. The last Chapter, chapter 5, is devoted to the various therapeutic agents and aids used in dentistry.

There are a number of foldouts that supplement this volume. These are numbered in the text of this volume and are located in the supplemental materials to Volume 4.

This volume is valued at 60 hours (20 points).

Material in this volume is technically accurate, adequate, and current as of 15 November 1983.

Contents

Page

Preface ... *iii*

Chapter

1 Basic Sciences ... 1

2 Dental Anatomy, Physiology, and Histology ... 61

3 Oral Pathology ... 95

4 Dental Materials ... 118

5 Dental Therapeutics ... 141

Bibliography ... 154

Answers for Exercises ... 155

CHAPTER 1

Basic Sciences

A BASIC KNOWLEDGE of science is important to you, the dental assistant, so that you may understand the body in health and disease. In this chapter we discuss anatomy, which is the study of the structure of we discuss anatomy, which is the study of the structure of function of the organism; chemistry, which deals with the composition, structure, properties and reactions of a substance; and microbiology, which deals with micro-organisms and their effects on other forms of life. A fundamental understanding of these basic sciences will provide you with a necessary building block for many areas of dentistry.

1-1. Anatomy and Physiology of Cells and Tissues

The human body is a complex organism made up of many smaller individual parts. In your Air Force training, you briefly studied the major systems, organs, tissues, and cells that make up the human body. This chapter will expand your area of study of the various parts of the body, their relationships to each other, and how they function to maintain the body.

200. Analyze the cell and specify its functions.

Cells. A cell is the smallest functioning unit of life that is capable of independent existence. Cells may exhibit the basic life processes of movement, respiration, digestion, excretion, and reproduction. The shape of a cell may be related to the function it will perform. A cell on the surface of the skin, for example, functions best as a thin, flat cell, whereas a red blood cell functions best as a round biconcave disc.

Protoplasm. The cell is microscopic in size and is formed from a jelly-like substance called protoplasm. Protoplasm is the essential substance of living cells upon which vital functions such as nutrition, secretion, growth, and reproduction depend. Protoplasm is often referred to as the "life substance," because it forms the physical basis of all living things. All the substances contained within the cell membrane comprise the protoplasm. A cell is composed of different parts, each having its own function (see fig. 1-1).

Nucleus. The nucleus is the control center of the cell. Chemical reaction and cell reproduction (mitosis) are controlled by the nucleus. Genes, which are biological units of heredity (a blueprint for an organism), are contained within the nucleus.

Nucleoplasm. Nucleoplasm is protoplasm located within the nucleus.

Cytoplasm. A watery form of protoplasm inside the cell is called cytoplasm and refers to all material lying outside the nucleus. The life processes of a cell take place in the cytoplasm. Cells live in a fluid environment and the fluids transfer food and oxygen from the blood through the cell membrane. Digestion and respiration occur within the cytoplasm.

External cell membrane. The external cell membrane functions as a cell wall or boundary that encloses all cells. It also functions as a semipermeable barrier that determines which nutrients and materials are taken into the cell (ingestion) and which substances are given off (excretion).

Some cells move by the protrusion of a pseudopodium (false foot). The protoplasm flows in one direction with the cell membrane extending along the forward edge of the protoplasmic mass like a false foot. The mass then moves into its extension and movement is accomplished. This type of movement is characteristic of a single-celled animal called the amoeba and is known as ameboid movement. Some blood cells have the ability to move in this manner.

Cell function. All living things perform vital functions (processes) such as respiration, digestion, excretion, and reproduction. The ability to perform these functions distinguishes protoplasm from nonliving matter. Each cell performs these functions within itself.

In an organism composed of only one cell, the cell and the organism are the same. The single cell carries out all the vital functions of the organism. Higher in the scale of life, the structure of the organism becomes more and more complex. The highest level of structure, the human body, represents an extremely complex collection of specialized cells. As each cell performs the vital functions necessary for it to stay alive, the body as a whole performs the same vital functions.

Metabolism and reproduction are important processes performed by cells. Metabolism is the chemical process that converts nutrients into energy and into new tissue (growth and repair). Metabolism combines the processes of assimilation (absorption of a substance), respiration, and excretion. Assimilation is the conversion of food into protoplasm for growth and repair of the body. The ability of the body to repair wornout, damaged, or nonfunctioning parts is essential to life. This repair process is possible because of the reproduction of cells.

The process of reproduction is carried out by most cells. Most cells, like organisms, reproduce their kind on an individual basis. Reproduction is essential for continuation

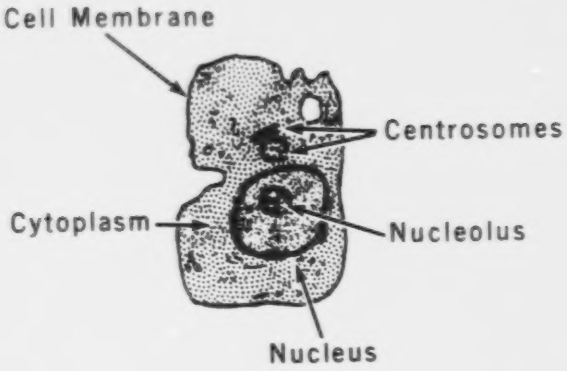


Figure 1-1. Parts of a cell.

of the species. Cells (with certain exceptions) reproduce for growth and repair of the organism. The organism reproduces for the perpetuation of the species (see fig. 1-2).

Centrosomes are rod-shaped bodies in the cytoplasm and are essential for reproduction. Most cells reproduce by splitting or dividing. The process of cell division is called mitosis and occurs in the following stages:

a. Prophase (first stage). During this stage the nuclear membrane disappears. Centrioles, which are located within the centrosome, become active and form spindles.

b. Metaphase (second stage). During this stage the chromosomes pull to the center of the cell. The chromosomes then duplicate themselves.

c. Anaphase (third stage). During this stage the two groups of chromosomes separate.

d. Telophase (fourth stage). During this final stage a nuclear membrane develops around the new cells and finally the daughter cells separate.

e. Interphase. No division processes occur during this stage. It is a resting period for the cell, as far as mitosis is concerned.

Specialized cells. There are a number of specialized cells which perform many different functions. Some of these cells have the ability to form tissue and substances in the body, while others remove or destroy tissues and substances in the body. Examples of specialized cells are as follows:

Formative. Formative cells are those cells that form tissue and substances and are identified by the suffix,*blast*. Examples of formative cells follow:

a. Ameloblasts are specialized cells which form the enamel of the tooth. Amelo (French for enamel); blast (formative cell).

b. Osteoblasts are specialized cells which form bone. Osteo (bone); blast (formative cell).

c. Odontoblasts are specialized cells which form dentin. Odonto (dentin); blast (formative cell).

Resorptive cells. Resorptive cells are cells that remove or destroy tissues and substances in the body and are identified by the suffix *clast*. The principal example of a resorptive cell is a osteoclast, which aids in the removal or resorption of bone.

Other specialized cells. It is beyond the scope of this text to cover all of the cells in the body on an individual basis. Some cells, however, are significant enough to mention because of their relationship to dentistry.

Neurons. Nuerons or nerves cells, transmit impulses from one part of the body to another.

Phagocytes. Phagocytes are cells that engulf foreign matter in the body such as bacteria.

Glandular cells. Glandular cells secrete chemical substances (salivary glands produce saliva).

Erythrocytes. Erythrocytes (red blood cells) transport oxygen from one part of the body to another.

Other cells. Other cells, such as those that form the muscles of the body, have the ability to shorten their length or contract and do so upon stimulation (receiving the proper nerve signal). Other cells that form the lining of the intestine have cell membranes that allow only certain elements of food to be picked up or absorbed into the cytoplasm. The nutrients are then released into the bloodstream to be transported throughout the body, where they are metabolized.

Exercises (200):

1. Which part of a cell forms the wall or boundary of the cell that limits the flow of the inner fluids?

2. What two processes occur within the cytoplasm of a cell?

3. Name the part of the cell that regulates the cell's activities.

4. Cite and define the stages of mitosis.

5. Define three specialized cells and cite their functions.

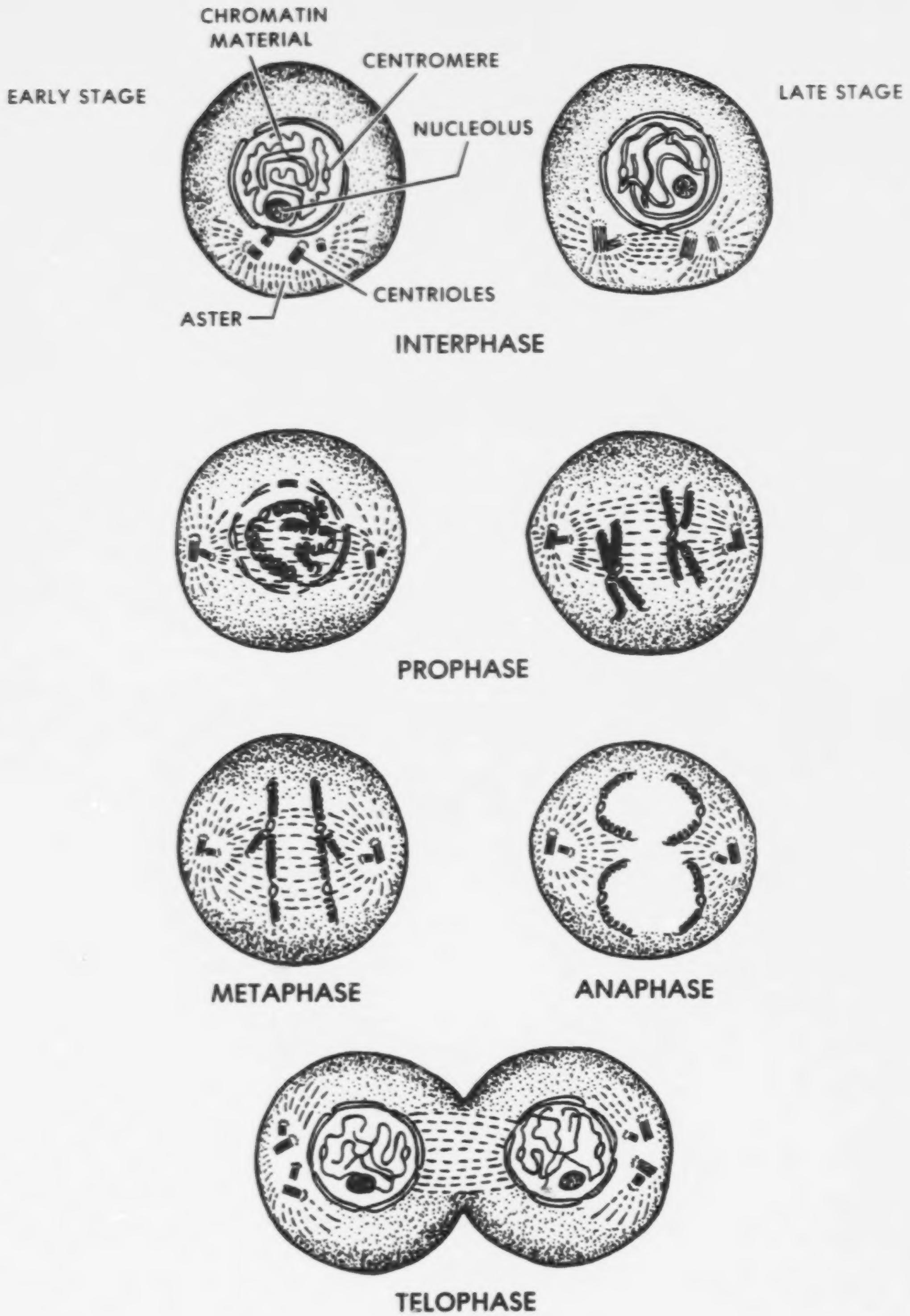

CHROMATIN MATERIAL
CENTROMERE
EARLY STAGE
NUCLEOLUS
LATE STAGE
CENTRIOLES
ASTER
INTERPHASE
PROPHASE
METAPHASE
ANAPHASE
TELOPHASE

Figure 1-2. Mitosis.

201. Specify the types of tissues in terms of function or structure.

Tissues. Tissues may be described as groups or a mass of specialized cells that have similar structure and function. The four main groups of tissue cells are epithelial, connective, muscle, and nerve. We will briefly discuss each group (see table 1-1).

Epithelial. Epithelial tissue covers the surface of the body, lines passageways and the cavities of the body (digestive and respiratory tracts), and forms secreting portions of glands, and some parts of the sense organs. These tissues are best recognized by the shape and arrangement of the cells such as the squamous or flat and the columnar or elongated cells.

Connective. Connective tissues form the supporting structures of the body and serve to bind parts and hold them in place. Connective tissues (formed by fibroblasts) serve as a major framework of organs and provide tissue spaces. Connective tissue also forms the "roadbed" for blood vessels, serves as packing for organs, and forms a net of elastic fibers that suspends soft organs such as the liver, spleen and lymph nodes. Scar tissue, ligaments, tendons and cartilage are all examples of connective tissue.

Muscle. Muscle tissues have the special characteristics of irritability (respond to stimuli), contractibility (shortening), extensibility (lengthening), and elasticity (can stretch and resume original shape). The three types of muscle tissue are the skeletal, smooth, and cardiac.

Skeletal. This type of muscle tissue comprises the muscles that are attached to, and enable the movement of, the different parts of the skeleton. Skeletal muscle tissue is also called striated muscle, which means that each fiber is cross-striped or comprised of alternate light and dark portions (see fig. 1-3.) Skeletal muscle tissue is also considered voluntary because the movements are, in most instances, under conscious control.

Smooth. This type of muscle tissue is found in the walls of interior organs of the body, such as the muscular layers of the intestines, the bladder, and the blood vessels. Visceral muscle tissue is considered as smooth or nonstriated because the fibers do not exibit the cross-striped appearance of the striated muscle (see fig. 1-3). Visceral muscle tissue is considered involuntary because movement of these muscles is accomplished through the autonomic nervous system (which is not under conscious control).

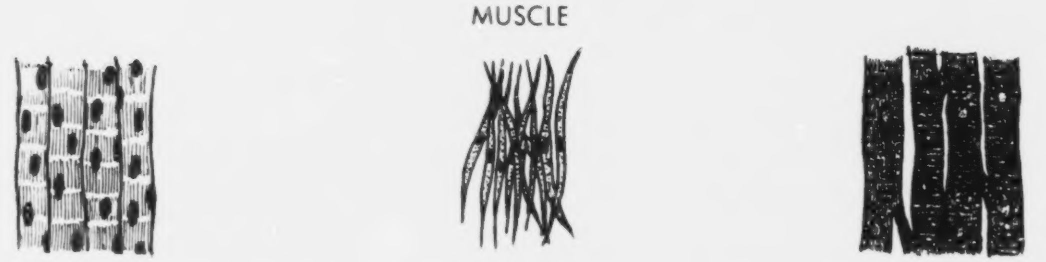
TABLE 1-1

BODY TISSUES

Type of Tissue	*Where Located*	*Purpose*
1. Epithelial	Skin Lining of passageways and cavities	Protection Absorption Secretion
2 Connective	Between organs and tissue Walls of vessels Skeleton Blood	Support Elasticity Insulation Protection Transportation of nutrients and waste
3. Muscle	Attached to bones Walls of organs Heart wall	Movement Support, elasticity Heart contractions
4. Nerve	Nerves Brain Spinal cord	Receive stimuli Conduct impulses Effect responses

Cardiac. The heart muscle is composed of this special type of involuntary muscle tissue. The structure of cardiac muscle tissue is different from that of the other muscle tissue. The fibers interlace with one another with only a minimum of connective tissue between them (see fig. 1-3). Cardiac muscle tissue is also considered involuntary and is found only in the heart.

Nerve. This type of tissue is the most highly specialized tissue in the body. The nervous system is the dominating machinery of the body and controls the reactions of the individual in response to changes that occur in and about him or her. Nerve cells, or neurons that make up nerve tissue, conduct electrical impulses. Nerve tissues includes sensory, which deals with pain and touch; motor, which activates muscles; and mixed, which are bundles of sensory and motor nerves.



Skelatal Voluntary Striated

Visceral Involuntary Smooth

Cardiac Involuntary

Figure 1-3. Muscle tissues.

Exercises (201):

1. Match the descriptive statement in column B with the proper item in column A.

Column A

____ (1) Epithelial tissue.
____ (2) Connective tissue.
____ (3) Muscle tissue.
____ (4) Nerve tissue.
____ (5) Skeletal tissue.
____ (6) Visceral tissue.
____ (7) Cardiac tissue.

Column B

a. The fibers interlace with one another with only a minimum of connective tissues between them.
b. The most highly specialized tissue in the body.
c. Lines passageways and the cavities of the body.
d. Fat, scar tissue, and cartilage are some examples of this tissue.
e. This type is also called striated muscle.
f. Has the special characteristics of irritability, contractibility, extensibility, and elasticity.
g. Considered involuntary because movements of these muscles are accomplished through the autonomic nervous system.

202. Identify aspects of blood quantity in an average adult, functions of formed elements, plasma, and the process of coagulation.

Blood. Blood is a red, sticky fluid circulating through the arteries, capillaries, and veins. The color of blood varies from bright red when it flows in the arteries to dark red when it flows in the veins. The average adult male has 5 to 6 quarts of blood while the female has slightly less. While the secondary functions of blood are numerous, its primary function is transportation. Blood carries oxygen from the lungs to the tissue cells and carbon dioxide from the tissue cells to the lungs. It also carries food materials (nutrients) absorbed from the digestive tract to the tissue cells and removes waste products for elimination by the excretory organs. Blood carries hormones from the ductless glands to the tissues and carries antibodies to protect the body against infection. Blood also helps to regulate body temperature and maintains the body's fluid balance (see table 1-2).

Blood cells. The formed elements of the blood consist of three types of cells: red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes) (see fig. 1-4).

Red blood cells. The erythrocyte has a biconcave disc shape and contains no nucleus. In the adult male, there are about 5 million red blood cells per cubic centimeter of blood. Their characteristic red color is due to the presence of hemoglobin, a substance composed of iron, salt, and a protein. Hemoglobin combines with oxygen to form oxyhemoglobin. Oxygen in this form is carried from the lungs to the tissue. Carbon dioxide is essentially carried in the blood plasma. The red blood cells are produced in the red marrow of the bones.

White blood cells. The leukocytes have a nucleus. They vary in shape and size and are almost colorless. The white blood cells are larger than red blood cells. Under normal conditions the white blood cells number from 6,000 to 8,000 per cubic centimeter of blood. An increase in the number of white cells is known as leukocytosis. A decrease in the number of these cells below the normal standard is called leukopenia. Leukocytes have the ability to move and change their shape (amoeboid movement). It is this ability to move that allows these cells to leave the capillary wall and move to the site of an infection. The white cells function to fight infection by enveloping and ingesting bacteria, a process called phagocytosis. When large numbers of white blood cells and bacteria destroy each other, they collect in pools called pus or exudate.

TABLE 1–2
FORMED ELEMENTS OF BLOOD

Element	*Source*	*Area of Destruction*	*Function*
1. Erythrocytes (red cells)	Bone Marrow	Spleen, Liver	Respiration: Hemoglobin portion carries oxygen to cells and carbon dioxide away.
2. Leucocytes (white cells)	Bone Marrow	Spleen, Liver	Fight infection
Granulocytes:			
Neutrophils			
Eosinophils			
Basophils			
Agranulocytes:			
Lymphocytes	Lymph Nodes		Fight infection
Monocytes	Unknown		Form scar tissue, Some antibody formation
3. Thrombocytes (platelets)	Bone Marrow	Blood Clots	Coagulation of blood

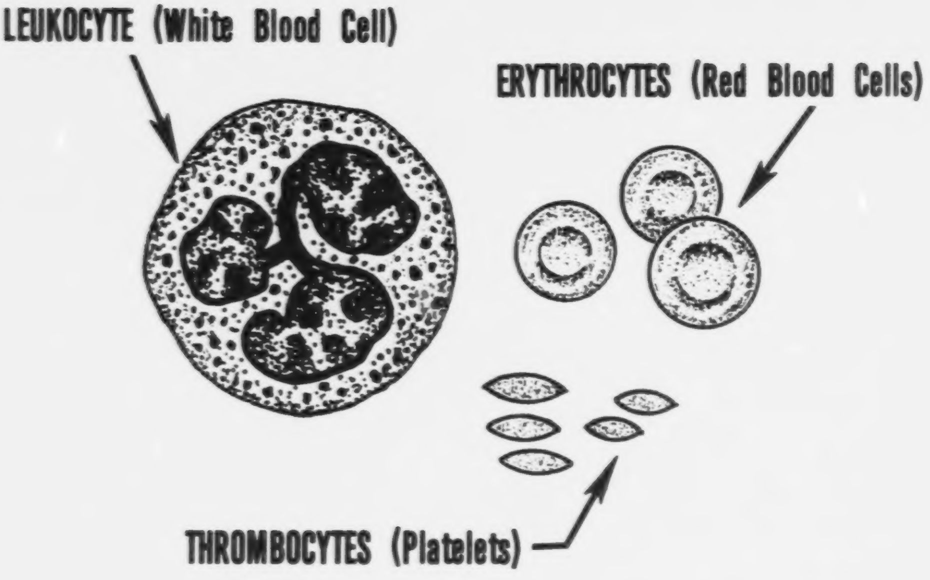


Figure 1-4. Blood cells.

Blood platelets. These cells contain certain chemicals necessary for blood clotting in their cytoplasm. They disintegrate at the site of injury and release these chemicals, which set up the coagulation process.

Plasma. This is the liquid portion of the blood. It carries all the cells mentioned above. In addition, it carries dissolved food products, cellular waste products, chemicals, and minerals.

Process of coagulation. Clotting or coagulation of the blood is essential for the preservation of life. Without proper coagulation, death would result from a minor cut. The clotting process progresses through four physical stages. These stages describe the condition of the blood flow.

The fluid stage. The fluid condition of the blood is simply the earliest flow which comes from a wound. If the pressure in the vessel is great enough to keep dislodging any attempt at clotting, the patient will continue to bleed. The flow must be slowed to allow the substances concerned with clotting to remain undisturbed long enough to react with each other. Pressure packs are used to stop the blood flow.

The viscous stage. The sticky or viscous stage slows the flow down and begins to form a framework for the stage which will finally cause the flow to stop.

The gel stage. The gel stage, like the setting of a collodial suspension, is the thickening process that continues until a plug is formed and the flow is stopped.

The organizational stage. The invasion of the clot by tissue-forming cells is called organization of the clot (healing). Clotting is both a chemical and physical reaction. It involves an intricate chain of events. For our discussion, the events can be simpified and traced through the substances involved.

(1) Thromboplastin. This substance is found in tissue fluid and is also formed by platelet breakdown. It is released from these two sources when tissue is damaged.

(2) Fibrinogen and prothrombin. These substances are soluble proteins formed by the liver. They are circulated through the blood by the blood plasma.

(3) Vitamin K. The wall of the decending colon produces this substance from certain substances in the feces. It is essential for the production of prothrombin by the liver.

The most essential part of a clot is an insoluble protein substance called fibrin. Fibrin is not present in normal whole blood but is formed when bleeding occurs. The platelets, which are very fragile, disintegrate and form thromboplastin, as do the tissue fluids. A reaction between the thromboplastin and blood calcium ions plus prothrombin forms thrombin which converts the soluble fibrinogen into the insoluble fibrin clot as follows:

- Platelet disintegration, plus tissue fluid, yields thromboplastin.
- Thromboplastin, plus calcium ions, plus prothrombin, yields thrombin.
- Thrombin, plus fibrinogen, yields fibrin clot.

The clot thus formed acts as a plug to close the wounded blood vessel and prevent great loss of blood. The clot is also the basis for the growth of new tissue in the healing process. The ability of the blood to clot differs in individuals. A clot will normally start to form within 3 to 5 minutes after the injury was sustained. Figure 1-5 shows a diagram of the clotting process.

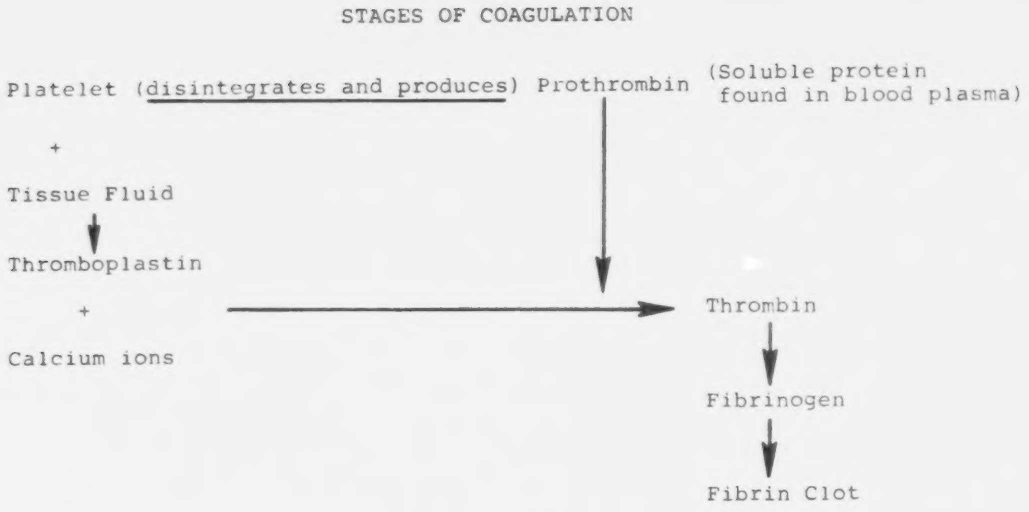


Figure 1-5. Stages of coagulation.

Exercises (202):

1. How much blood is found in the average adult male?

2. Name the three formed elements of blood and the primary function of each.

3. What is plasma?

4. Briefly explain the clotting mechanism.

203. Specify the functions of the body systems.

Body Systems. The body organs are grouped into systems that perform particular functions. Some systems are described below:

a. Integumentary System (Skin). Covers and protects the body from injury, disease, and infection. It has functions of sensation, thermal regulation and secretion.

b. Skeletal System. Provides a framework for the body, supports the organs, and furnishes a place of attachment for muscles.

c. Muscular System. Permits motion and propulsion of the body.

d. Circulatory System. Transports oxygen and nutrition in blood to all parts of the body and carries away the waste products formed by cells.

e. Respiratory System. Removes oxygen from inhaled air and gives off carbon dioxide produced by cells of the body.

f. Digestive System. Digests and absorbs food substances and excretes waste products.

g. Excretory System. Excretes liquid and solid waste products.

h. Nervous System. Gives the body awareness of its environment and enables it to react to stimuli from that environment.

i. Endocrine System. Secretes chemical substances (hormones) that affect the activity of cells.

j. Reproductive System. Produces and transports reproductive cells.

Exercises (203):

1. Identify each true statement and explain why the others are false.

____ 1. The integumentary system functions in sensation and thermal regulation.
____ 2. The skeletal system functions only as a framework for the body.
____ 3. The muscular system restricts all motion of the body.
____ 4. The circulatory system transports oxygen and nutrition in the blood to all parts of the body.
____ 5. The respiratory system removes carbon dioxide from inhaled air.
____ 6. The digestive system digests and absorbs food substances.
____ 7. The excretory system excrets liguid and solid waste products.
____ 8. The nervous system prevents the body from reacting to stimuli from its environment.
____ 9. The reproductive system produces and transports reproductive cells.

1-2. Anatomy and Physiology of the Integumentary System

Have you ever examined any fruits or vegetables closely? If you did and gave it some thought, you may have noticed a similarity between those items and your own body. Give up? It is the covering that protects them and contains the inner parts. We also have a protective covering called skin. Of course, the scientific name would be integument. What are some of the skin structures, and how do they function? Let's answer some of those questions because the skin is a body system that has a big influence on all the other body systems.

204. Specify composition and functions of the integumentary system.

Integumentary Structures. The skin is a tough, elastic structure covering the body. It consists of two principal layers. The outer layer is the epidermis (shown in fig. 1-6) and the inner layer is the dermis or true skin. The epidermis itself is composed of a superficial layer and an inner layer. The superficial or hornified layer consists of flat and lifeless cells that are constantly being worn off and then replaced by the living cells which form the inner layer. Hair and nails are modified epidermis. Hair is present in varying lengths and thicknesses on almost the entire surface of the body, except the palms of the hands and soles of the feet. The parts of the hair are the root, the portion below the surface, and the shaft, the portion above the surface. The shaft contains pigment (color). The root is embedded in a pit-like depression called a hair follicle. The dermis is the thicker part of the skin; it consists of connective tissues containing blood vessels, nerve endings, sweat glands, sebaceous glands, and hair follicles. The dermis is held in place by a layer of connective tissue.

Functions of the Skin. The skin covers and protects underlying structures from injury and death. If the hornified layer is unbroken, it can block the passage of almost every known variety of germ. It also plays a great part in regulating body temperature, for it forms a large radiating surface.

The sweat glands can cool the body through evaporation of sweat. Sweating is also a means of excreting waste. The sweat glands are coiled tubular glands embedded in the dermis and surrounded by small tufts of capillaries. These glands, located partly in subcutaneous tissue, open by means of ducts to the surface of the skin (refer again to fig. 1-4). Normally, about 1 liter of fluid is excreted daily, but the amount varies with atmospheric temperature, humidity, body temperature, and the amount of exercise that is taken. Sweat consists of water (99 percent), salts, and organic waste products. Sebaceous glands are associated with the hair follicle mentioned in the preceding paragraph. They

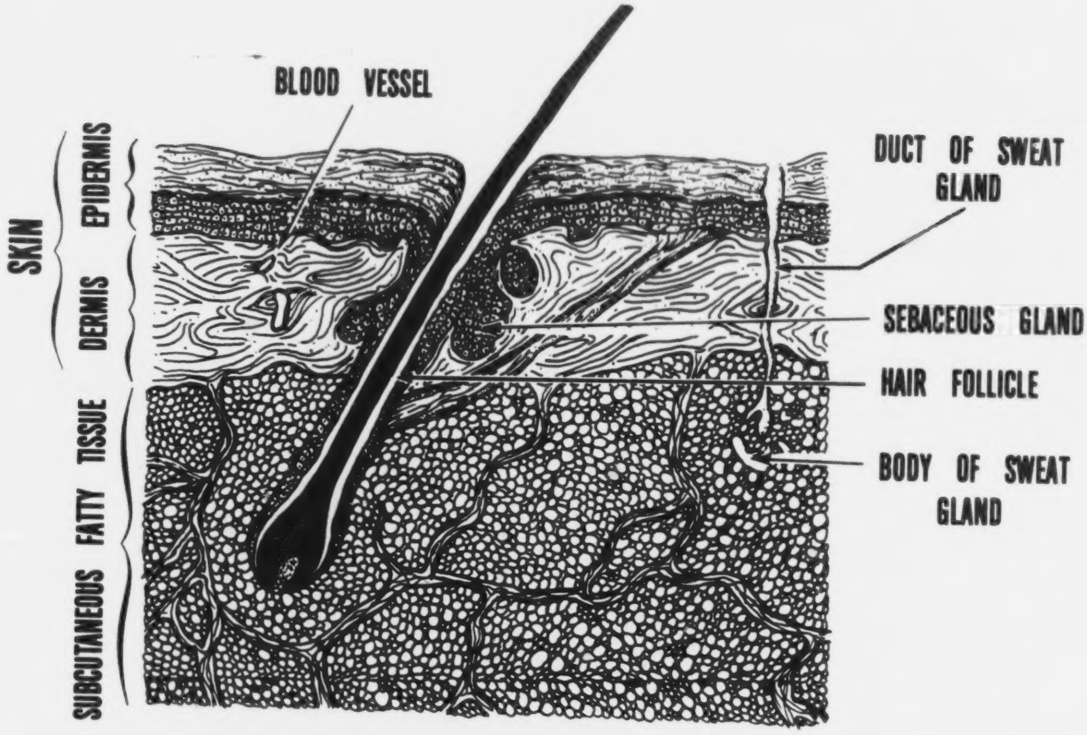


Figure 1–6. Integumentary structures.

secrete oil and sebum (fat and cellular debris), and empty into the hair follicles near the surface of the skin. Sebum keeps the hair from becoming dry or brittle and forms a protective film on the skin, which limits evaporation and absorption of water.

Exercises (204):

Identify each true statement and explain why the others are false.

____ 1. The layers of the skin are the dermis and epidermis.
____ 2. The epidermis is considered the true skin.
____ 3. The two parts of hair are the roots and shafts.
____ 4. The structures within the dermis are the blood vessels, connective tissue, nerve endings, sweat glands, and hair follicles.
____ 5. The skin keeps the body cool by secreting sweat that evaporates.
____ 6. The skin is considered an excretory device because it rids the body of waste through the sweat glands.
____ 7. The skin will normally secrete about 2 liters of fluid each day.
____ 8. The excretory rate of the skin depends on atmospheric pressure, exercise, body temperature, and humidity.
____ 9. Hair is prevented from becoming dry by the sebum.

1-3. Anatomy and Physiology of the Skeletal System

Chances are you have noticed a house being built and remember the stage where only the framework was standing. The framework was made of heavy lumber and gave stability to the entire house. The human skeleton is much the same. It acts as a strong, supporting framework that gives stability and shape to the rest of the body. This section covers bone functions, bone types, and bone structure.

205. Specify the number, type, composition, and functions of bones in the human skeleton.

Functions. The functions of the 206 bones of the skeletal system are to give the body support and shape; to protect certain organs that might be easily injured; to furnish a system that gives movement with the assistance of muscles; and to contain bone marrow which manufactures blood cells. Foldout 1-1 of supplementary material to Volume 4 shows the types of bones, the number of each type, and their specific locations.

Types of Bones. Bones are classified by their shape as:

a. Long—femur and humerus.
b. Short—wrist (carpus) and ankle (tarsus).
c. Flat—skull, sternum, and scapula.
d. Irregular—vertebrae, mandible, and pelvis.

Structure of Bones. Bone structure consists of a hard outer layer (compact bone), an inner layer of spongy (cancellous) tissue, and a central (medullary) canal containing marrow. There are two types of marrow—red, which is the manufacturing center of the red blood cells and of some white blood cells; and yellow, in which fat cells predominate. The surface of bone is covered with a thin membrane (periosteum) that contains nerves and blood vessels. New bone is formed from this membrane. In cases of fracture, the sensation of pain arises from the periosteum, not from the bone. Bone is both hard and elastic. It is two-thirds mineral matter (lime salts) to give it hardness, and one-third organic matter (protein) to give it elasticity. As age increases, the proportion of mineral increases, making bones more brittle and more easily broken. As you can readily see, bones are complex and play an important role in our life process.

Exercises (205):

1. How many bones are found in the human skeleton?

2. Name the four types of bones and give one example of each.

3. What processes take place in bone marrow?

4. What is the hard outer layer of bone called?

5. When a fracture occurs, where is the sensation of pain felt?

6. What is bone composed of?

1-4. Anatomy and Physiology of the Muscular System

You may recall that the skeletal system can be compared to the framework of a house. When you add muscles to the skeleton, it is similar to plaster material added to the framework of the house. Of course, muscles, unlike plaster, are used to aid body movement. This section discusses the purpose of the muscular system, muscle groups, locations of muscles, and their related functions.

206. Cite the relationship of the muscular system to the entire body weight, size of the muscles, and essential body functions that are aided by muscles.

General Functions. It may surprise you to learn that one-half of your body weight is made up of muscles. Also, the form the body takes is due largely to the muscles which cover the bones. If your body had no skin to cover it, most of your skeleton would still be covered by muscles. Limb movement, locomotion, and erect posture are provided by your muscles. They also aid such essential body functions as circulation of the blood, respiration, and digestion. Your sight and speech are also aided by muscle activity. More than 500 muscles are large enough to be seen by the naked eye, while many others are microscopic. This CDC will not attempt to describe all the muscles but only the major functional ones, as shown in figures 1-7 and 1-8.

Exercises (206):

1. How much of your body weight is muscle?

2. What essential body functions are aided by muscles?

3. How many of muscles are large enough to be seen by the naked eye?

207. Identify the two main muscle groups, and contrast their structures and functions.

Muscle Groups. Generally speaking, our muscles are divided into two main groups—voluntary and involuntary. They have contrasting and peculiar characteristics, as the following material explains.

Voluntary muscle. Voluntary muscle is so-called because it is controlled by will through the central nervous system. All the skeletal muscles (the muscles attached to the skeleton) are of the voluntary type. Because microscopic examination shows it to be crosshatched, voluntary muscle is known also as striated muscle. Besides the skeletal muscles, those that move the eyeballs, tongue, and pharynx are voluntary. Each skeletal muscle is made up of three main parts. They are (1) the origin, (2) the belly, and (3) the insertion. The origin is the point at which the muscle is anchored and usually consists of a short tendon attached to the bone. (Tendons are made up of nonelastic, dense, fibrous tissue.) The belly is the largest part of the body and is made up of many fibers. The insertion is the point upon which the action of the muscle is applied, resulting in motion.

Involuntary muscle. An involuntary muscle is so-called because its nerve supply comes from the autonomic nervous system (the part of the nervous system over which we have no direct control). Because it does not appear under microscopic examination to be striated, involuntary muscle is called smooth muscle. It is found in the walls of the blood vessels, respiratory passages, gastrointestinal tract, ureters, urinary bladder, and certain other organs. A special kind of involuntary muscle is the cardiac muscle. Its structure is quite different from that of any other muscle in that it is both smooth and striated.

Exercises (207):

1. Name the two principal muscle groups.

2. Name the three main parts of a skeletal muscle.

3. Which type of muscle (voluntary or involuntary) moves the eyeballs, tongue, and pharynx?

4. Which type of muscle (voluntary or involuntary) controls the heart, via the autonomic nervous system?

5. Name the special kind of involuntary muscle that is both smooth and striated.

208. Specify the functions of major muscles.

Major Functional Muscles. This previous section explained the purpose of muscles and presented contrasts between the two types, voluntary and involuntary. The following section it concentrates on the major functional muscles—those that are more obvious in our daily activities. Figures 1-7 and 1-8 exhibited both anterior and posterior views of these muscles.

Masseter. This muscle raises the mandible to close the mouth and is the muscle used in mastication of food. The masseter muscle originates in the zygomatic process and adjacent parts of the maxilla and is inserted in the mandible.

Temporalis. The temporalis muscle assists the masseter and draws the mandible backward. It has its origin in the temporal fossa and is inserted in the coronoid process of the mandible. (Note: This muscle is not shown in the illustrations.

Sternocleidomastoid. This muscle is located on the side of the neck, serving as a liner. In one instance, it acts to pull the head left or right of the shoulder and, in another, it acts to flex the head toward the chest or shoulders. It originates in the sternum and clavicle with its insertion in the mastoid process of the temporal bone.

Trapeziius. The trapezus muscles are a pair of broad, diamond-shaped muscles on the upper back that raise or lower the shoulders. These muscles cover approximately one-third of the back. They originate in the very large area comprised of 12 thoracic vertebrae, seven cervical vertebrae, and the occipital bone, and have their insertion in the clavicle and scapula.

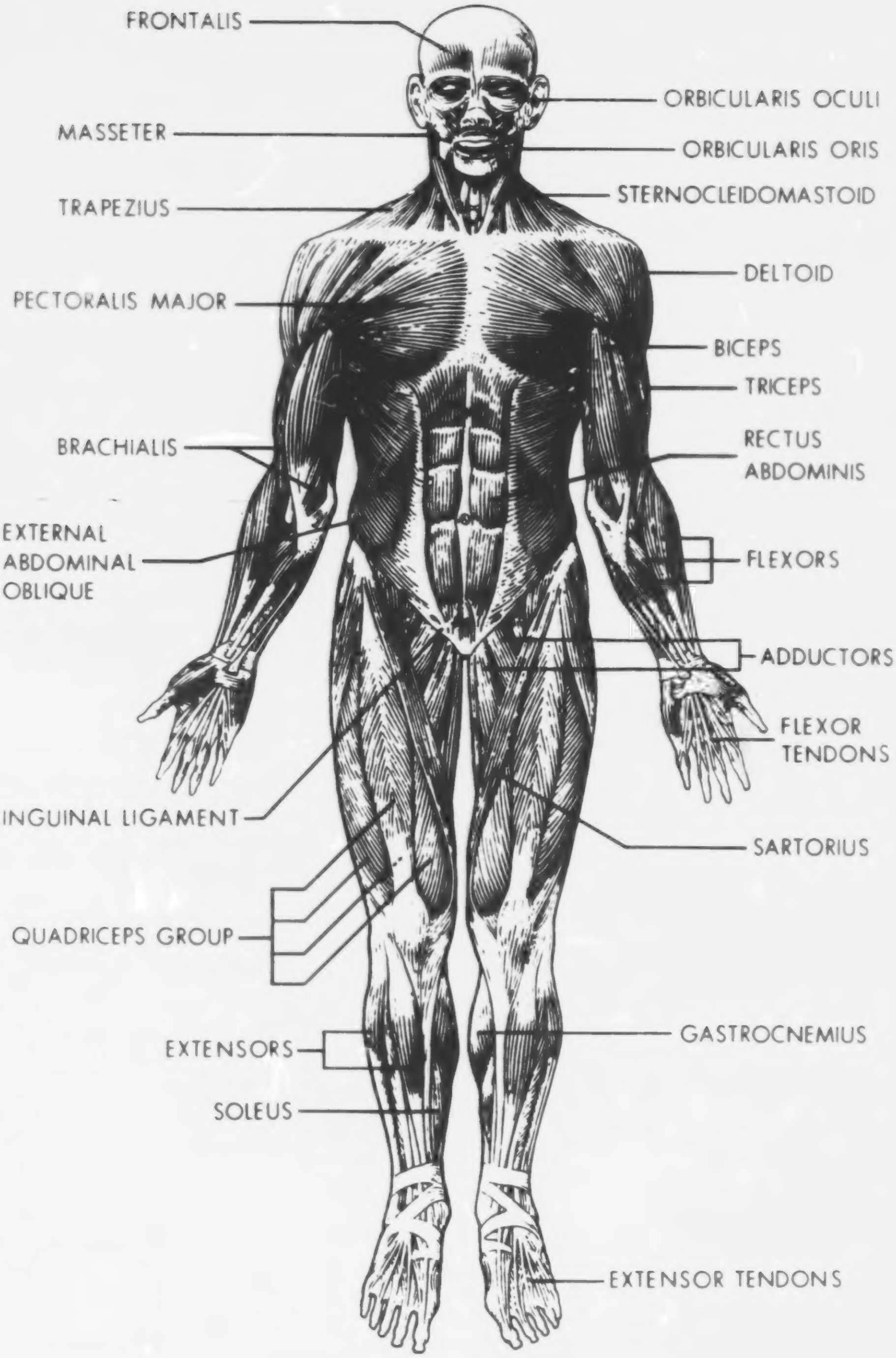

FRONTALIS
ORBICULARIS OCULI
MASSETER
ORBICULARIS ORIS
TRAPEZIUS
STERNOCLEIDOMASTOID
DELTOID
PECTORALIS MAJOR
BICEPS
TRICEPS
BRACHIALIS
RECTUS ABDOMINIS
EXTERNAL ABDOMINAL OBLIQUE
FLEXORS
ADDUCTORS
FLEXOR TENDONS
INGUINAL LIGAMENT
SARTORIUS
QUADRICEPS GROUP
GASTROCNEMIUS
EXTENSORS
SOLEUS
EXTENSOR TENDONS

Figure 1–7. Major muscles of the body (anterior view).

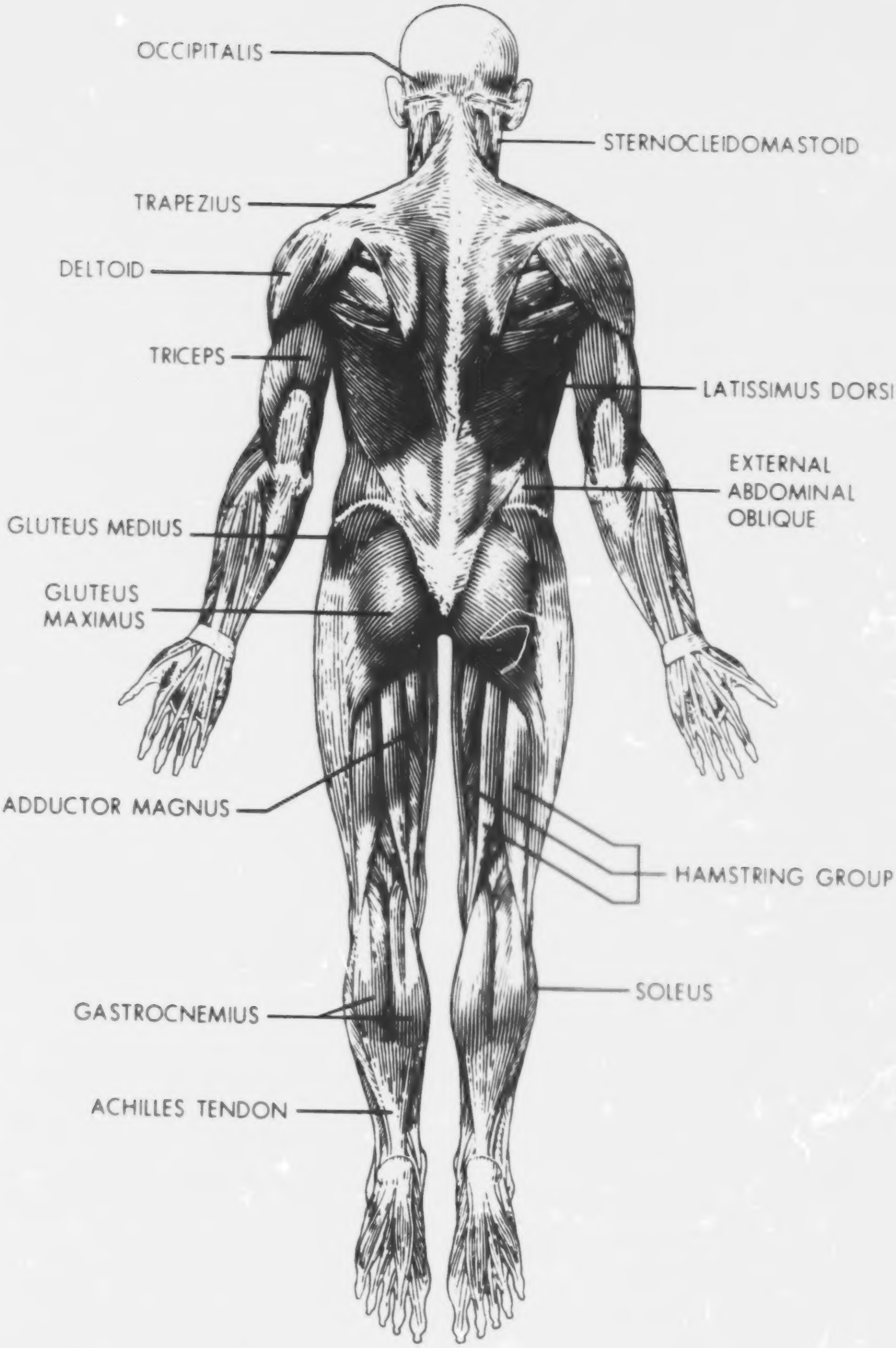

OCCIPITALIS
STERNOCLEIDOMASTOID
TRAPEZIUS
DELTOID
TRICEPS
LATISSIMUS DORSI
EXTERNAL ABDOMINAL OBLIQUE
GLUTEUS MEDIUS
GLUTEUS MAXIMUS
ADDUCTOR MAGNUS
HAMSTRING GROUP
SOLEUS
GASTROCNEMIUS
ACHILLES TENDON

Figure 1–8. Major muscles of the body (posterior view).

Deltoid. The deltoid abducts (draws away) the arm and has its origin in the clavicle and spine of the scapula shoulder blade. Its insertion is on the lateral side of the humerus (upper arm) and it fits as a cap over the shoulder.

Pectoralis major. This muscle rotates the arm inward and draws the arm across the chest. It originates in the clavicle, sternum, and cartilages of the true ribs and the external oblique muscle. Its insertion is found in the greater tubercle of the humerus. It is the prominent chest muscle.

Latissimus dorsi. This a broad, flat muscle that draws the arm downward and backward and rotates it inward. It covers approximately one-third of the back on each side. This muscle arises from the upper thoracic vertebrae to the sacrum and the posterior portion of the chest of the ilium. These fibers converge to form a flat tendon that has its insertion in the humerus.

Biceps. This muscle flexes the elbow and turns up the hand. In the anatomical position, it is located on the anterior surface of the upper arm. It has its origin in the outer edge of the glenoid cavity and its insertion in the tuberosity of the radius. The brachialis and the biceps are its opposing muscles. The triceps is the great extensor of the forearm, while the brachialis is the flexor of the forearm.

Diaphragm. Besides being the primary muscle of respiration, this muscle forms the floor of the thoracic cavity and the ceiling of the abdominal cavity. (Note: The diaphragm is not illustrated.) It modifies the vertical size of the thorax and abdomen. It has two large openings, the esophageal and the vena cava. A third opening, the aortic opening, lies behind the diaphragm. These openings allow for the passage of nerve and blood vessels.

Gluteus maximus. This is the largest muscle of the buttock. It extends the femur and rotates it outward. It has its origin in several areas—the crest of the ilium, the posterior surface of the lower sacrum, and the side of the coccyx.

Sartorius. This is the longest muscle of the body. It extends obliquely across the thigh anteriorly. It flexes the thigh on the hip and the leg on the thigh, and also rotates the thigh outward.

Gracilis. This long, slender muscle is located on the inner area of the thigh. It assists in adducting (turning inward) the thigh and flexing the leg. It originates in the symphsis puluis and has its insertion in the medial surface of the tibia below the condyle.

Biceps femoris (hamstrings). This muscle acts to flex the leg on the thigh and to extend the thigh. It originates from the tuberosity of the ischium. It has its insertion in the lateral side of the head of the fibula and lateral condyle of the tibia. It is often called the hamstring muscle.

Calf muscle. The main muscles of the calf are the gastrocnemius and the soleus. The gastrocnemius originates at the distal end of the femur and the soleus from the head of the fibula and medial border of the tibia. Both are inserted in a common tendon,, called the calcaneus or achilles tendon. This tendon has its insertion in the heal or calcaneus bone. The muscles extend the foot at the ankle.

Exercises (208):

1. Match the major functional muscles in column B with the correct description in column A. Column B items may be used only once.

Column A

_____ (1) Located on the side of the neck.
_____ (2) Raises or lowers the shoulder.
_____ (3) Primary muscle of respiration.
_____ (4) Flexes the elbow.
_____ (5) Abducts the arm.
_____ (6) Assists in the adduction of the thigh.
_____ (7) Longest muscle of the body.
_____ (8) Rotates the arm inward.
_____ (9) Covers one-third of the back.
_____ (10) Largest muscle of the buttock.
_____ (11) Use in food mastication.
_____ (12) Hamstring muscle.
_____ (13) Origin at the distal end of the femur.
_____ (14) Draws the mandible backward.

Column B

a. Gastrocnemius.
b. Biceps femoris.
c. Gracilus.
d. Sartorius.
e. Masseter.
f. Temporalis.
g. Sternocleidomastoid.
h. Gluteus maximus.
i. Deltoid.
j. Pectoralis major.
k. Diaphragm.
l. Biceps.
m. Latissimus dorsi.
n. Trapezius.

1-5. Anatomy and Physiology of the Circulatory System

Did you ever stop to consider the wonder of the system that never ceases to work, day and night, moment by moment, from the day you are born until the day you die? No machine known to man could ever compare to the heart in relation to its productivity and longevity. What is the extent of the circulatory system? Of what is the system composed? This section will attempt to answer the questions you may have about the heart, the venous system, the arterial system and the related lymphatic system.

209. Analyze the circulatory system.

Circulatory System. The circulatory system assists respiration and excretory functions by carrying oxygen from the lungs to the cells and carbon dioxide from the cells to the lungs. It also transports waste products to the organs of excretion. The circulatory system provides a nutritive function by carrying amino acids (organic compounds), lipids (insoluble fats), inorganic salts, and vitamins from the digestive tract to the cells. It also distributes the hormones of the endocrine glands to the cells which they regulate.

The circulatory system helps to protect the body by aiding in the defense against injurious agents by means of immune substances and white blood cells. It helps to equalize body temperature by giving off heat from the superficial blood vessels and by transporting water and other substances to excretory organs.

The circulatory system is subdivided into three parts:

a. Systemic circulation includes blood flow to all parts of the body except the lungs. It consists of all the arteries, veins, and capillaries of the body except those of the lungs.

b. Pulmonary circulation includes the flow of blood through the right ventricle, pulmonary arterial systems, lungs, pulmonary venous system, and left atrium.

c. Portal circulation carries the blood from the abdominal viscera (stomach cavity) through the liver by way of the portal vein. Here substances in the blood are processed in the liver.

Exercises (209):

1. How does the circulatory system support respiratory and excretory functions?

2. How does the circulatory system protect the body?

3. Which one of the three parts of the circulatory system, with the exception of the lungs, includes blood flow to all parts of the body?

210. Cite the segments of the cardiovasular system.

The Cardiovascular System. The cardiovascular system comprises the heart and blood vessels. The heart propels blood through the blood vessels—a system of closed tubes composed of arteries, capillaries, and veins.

The heart, a hollow, muscular organ, lies between the lungs in the lower portion of the thoracic cavity. It is somewhat cone-shaped with the apex directed downward and to the left. It is about the size of a man's fist with much of its base lying immediately behind the sternum. It is enclosed in a membranous sac called the pericardium. The pericardium has two layers, the visceral and the parietal pericardium. The space between these two layers contains pericardial fluid, which provides a type of lubrication and smooth surfaces for movement of the heart during its expansion and contraction.

The heart is composed of three layers of tissue. The epicardium is the outer layer; the myocardium is the thick, middle layer of muscle fibers; and the endocardium lines the heart, covers the valves, and is continuous with the lining of the blood vessels. See figure 1-9, and refer to it throughout this section.

The interior of the heart is divided into a right and a left portion by a septum (a dividing wall or partition). In each half there is an upper chamber (the atrium), which receives blood from the veins, and a lower chamber (the ventricle), which receives blood from the atrium and pumps it out into the arteries. The openings between the chambers on each side of the heart are supplied with one-way valves that prevent backward flow of the blood. The valve on the right is the tricuspid valve; the one on the left, the bicuspid or mitral valve. The semilunar valves are located at the outlets of the ventricles. On the right, the pulmonary valve is at the origin of the pulmonary artery. The one on the left side is located at the origin of the aortic valve.

Physiologically, the heart acts as two separate pumps. The right side receives deoxygenated blood into the atrium from the various regions of the body. Then the ventricle pumps it into the lungs. There it receives a fresh supply of oxygen and gives off carbon dioxide. This phase is called the pulmonary circulation. The left side of the heart receives the oxygenated blood from the lungs into the atrium, and the ventricle pumps it into all regions of the body through the arteries. This phase is called the systemic circulation.

Each contraction of the heart is followed by limited relaxation. The cardiac muscle never completely relaxes but always maintains a degree of tone. The period of contraction of the heart is called systole (sis-tuh-lee) and is the period of work; the period of relaxation of the heart is called diastole (dye-as'tuh-lee) and is the period of rest. A complete cardiac cycle is the time from the onset of one contraction or heartbeat to the onset of the next.

The heart has its own system of blood vessels. The right and left coronary arteries arise from the aorta as soon as it leaves the heart. The coronary sinus collects the venous blood from the heart and empties it directly into the right atrium.

The contractions of the heart are stimulated and maintained by an "electrical pacemaker" inside the heart. It is under the influence of a dual nervous system which is normally finely balanced. The pair of vagus nerves (these are cranial nerves) produce an action of slowing the heart rate, while the thoracic nerves from the autonomic nervous system produce an action of increasing the heart rate. Under periods of work, stress, or emergency, the accelerating effect is predominant and the cardiac rate is increased.

Sensory nerve fibers of the heart are stimulated by reduced blood flow through the muscle fibers of the heart and produce the sensation of pain. The brain sometimes mistakenly interpets these signals as coming from the nerves that supply the inner side of the arm and, in some people, the left side of the neck and lower jaw. Patients who have heart diseases that produce impaired circulation often complain of severe pain in the inner side of the left arm or jaw when the actual source of pain is the heart.

The blood vessels of the body fall into three principal classes. One is the distributing system made up of arteries and smaller branches, the arterioles. Another is a system of minute vessels, the capillaries, through which substances are exchanged between blood and tissues. Finally, there is a collecting system made up of venules and veins that returns the blood to the heart. Figure 1-l0 shows the major arteries in the body. Study this figure and refer to it throughout the study of the arteries.

The arteries are elastic tubes, capable of withstanding high pressure. They carry blood from the heart. They also lead to branches of various sizes which, in turn, divide and subdivide into smaller and smaller vessels. The terminal branches are called arterioles. The muscular wall of the arteries is under the control of nerves that relax or contract to increase or decrease the diameter of the vessels. In this way, blood pressure is regulated.

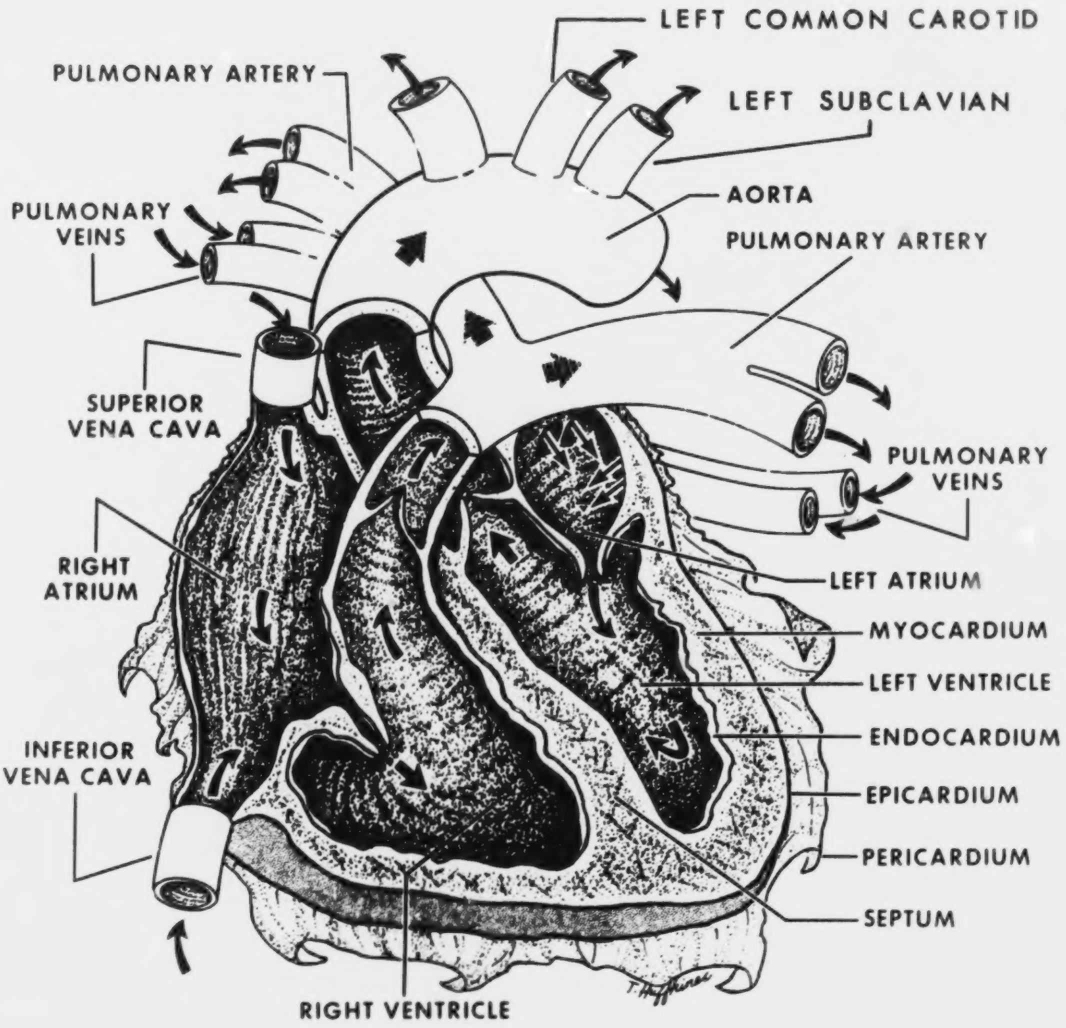

LEFT COMMON CAROTID
PULMONARY ARTERY
LEFT SUBCLAVIAN
PULMONARY VEINS
AORTA
PULMONARY ARTERY
SUPERIOR VENA CAVA
PULMONARY VEINS
RIGHT ATRIUM
LEFT ATRIUM
MYOCARDIUM
LEFT VENTRICLE
INFERIOR VENA CAVA
ENDOCARDIUM
EPICARDIUM
PERICARDIUM
SEPTUM
RIGHT VENTRICLE
T. Huffines

Figure 1–9. The heart.

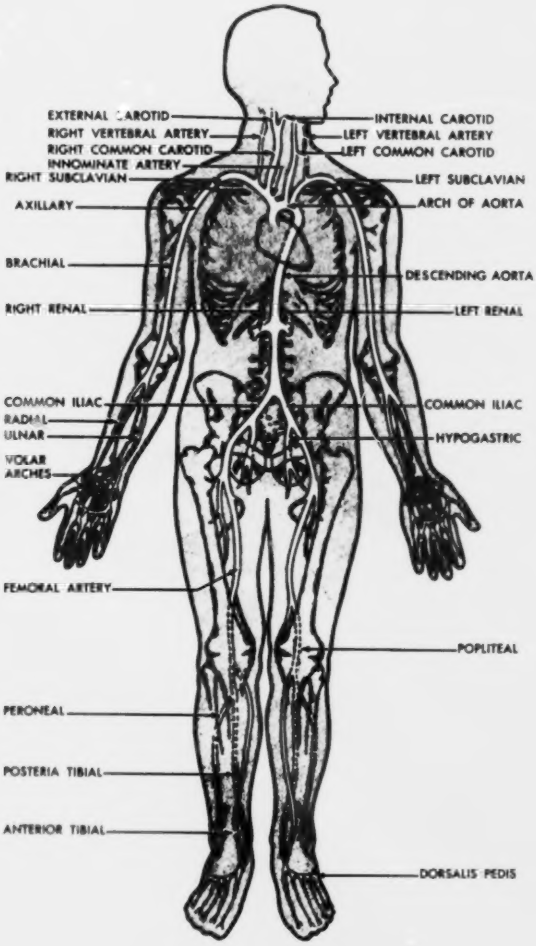

EXTERNAL CAROTID
RIGHT VERTEBRAL ARTERY
RIGHT COMMON CAROTID
INNOMINATE ARTERY
RIGHT SUBCLAVIAN
AXILLARY
BRACHIAL
RIGHT RENAL
COMMON ILIAC
RADIAL
ULNAR
VOLAR ARCHES
FEMORAL ARTERY
PERONEAL
POSTERIA TIBIAL
ANTERIOR TIBIAL
INTERNAL CAROTID
LEFT VERTEBRAL ARTERY
LEFT COMMON CAROTID
LEFT SUBCLAVIAN
ARCH OF AORTA
DESCENDING AORTA
LEFT RENAL
COMMON ILIAC
HYPOGASTRIC
POPLITEAL
DORSALIS PEDIS

Figure 1-10. Major arteries in the body.

At the ends of the arterioles is a system of minute vessels that vary in structure but are spoken of collectively as capillaries. They have very thin walls and communicate with each other to form a dense interlacing network in all parts of the body. As the blood passes through the capillaries, it gives oxygen and nutritive substances to the tissues and takes up various waste products to be carried away by the veins (see fig. 1-11).

The veins comprise a system of vessels that collect the blood from the capillaries and carry it back to the heart. Their structure is similar to that of the arteries except that their walls are thinner with less muscle tissue. Veins begin as tiny venules, which are formed from capillaries joining together much as tiny streams connect to form a river. The force of muscles contracting adjacent to veins and the action of the diaphragm aid in the forward propulsion of blood on its return trips to the heart. Valves, spaced intermittently along the larger veins, prevent backflow of blood. The major veins of the body are shown in figure 1-12.

Exercises (210):

1. Match the statements in column B with the items in column A.

Column A

____ (1) Atrium.
____ (2) Ventricle.
____ (3) Arteries.
____ (4) Capillaries.
____ (5) Veins.

Column B

a. As the blood passes through this segment of the cardiovascular system, it gives oxygen and nutritive substance to the tissues.
b. Receives blood from the veins.
c. Elastic tubes that carry blood from the heart.
d. Receives blood from the atrium and pumps it out into the arteries.
e. Collect blood from the capillaries and carry it back to the heart.

211. Specify the function and structure of the segments of the lymphatic system, to include lymph, lymph vessels, and lymph nodes.

The Lymphatic System. The lymphatic system is that part of the circulatory system that conveys lymph from the body tissues to the point where it reenters the bloodstream. The fluid of the lymphatic system is known as tissue fluid and is formed from blood plasma. It acts as a middle man between the blood and tissues as it filters its way through the walls of the capillaries into the lymphatics. Here it washes all portions of the body not reached by the blood. It also carries food and oxygen to the cells and removes wastes. Unfortunately, infectious material and malignancies also can spread through the body by way of the lymphatic system.

Components of the lymphatic system. The lymphatic system has no pump similar to the heart. The lymph is kept moving by the contraction of the smooth muscles on the vessels and by the massaging action of the skeletal muscles.

The *lymph capillaries* carry lymph from tissue spaces to the lympathic vessels. The *lymph vessels* carry lymph to the lymph ducts. These vessels contain valves which give them a characteristic beaded appearance. *Lymph ducts* empty into the venous system, and it is here that the lymph reenters the general circulation.

Lymph nodes are small, oval bodies found at intervals in the course of the lymph vessels. Groups of both deep and superficial (near the surface) nodes are found throughout the body. Figure 1-13 shows the distribution of lymph nodes in the body. These nodes filter out any contaminants and prevent them from entering the general circulation. White blood cells are found in the lymph nodes. They aid in the destruction of foreign matter. This process often produces tenderness and swelling in the nodes of an infected area.

Related organs of the lymphatic system. The spleen lies in the upper left abdomen beneath the diaphragm and behind the lower ribs and costal cartilages. Its functions are blood destruction and blood production, in that it exerts an

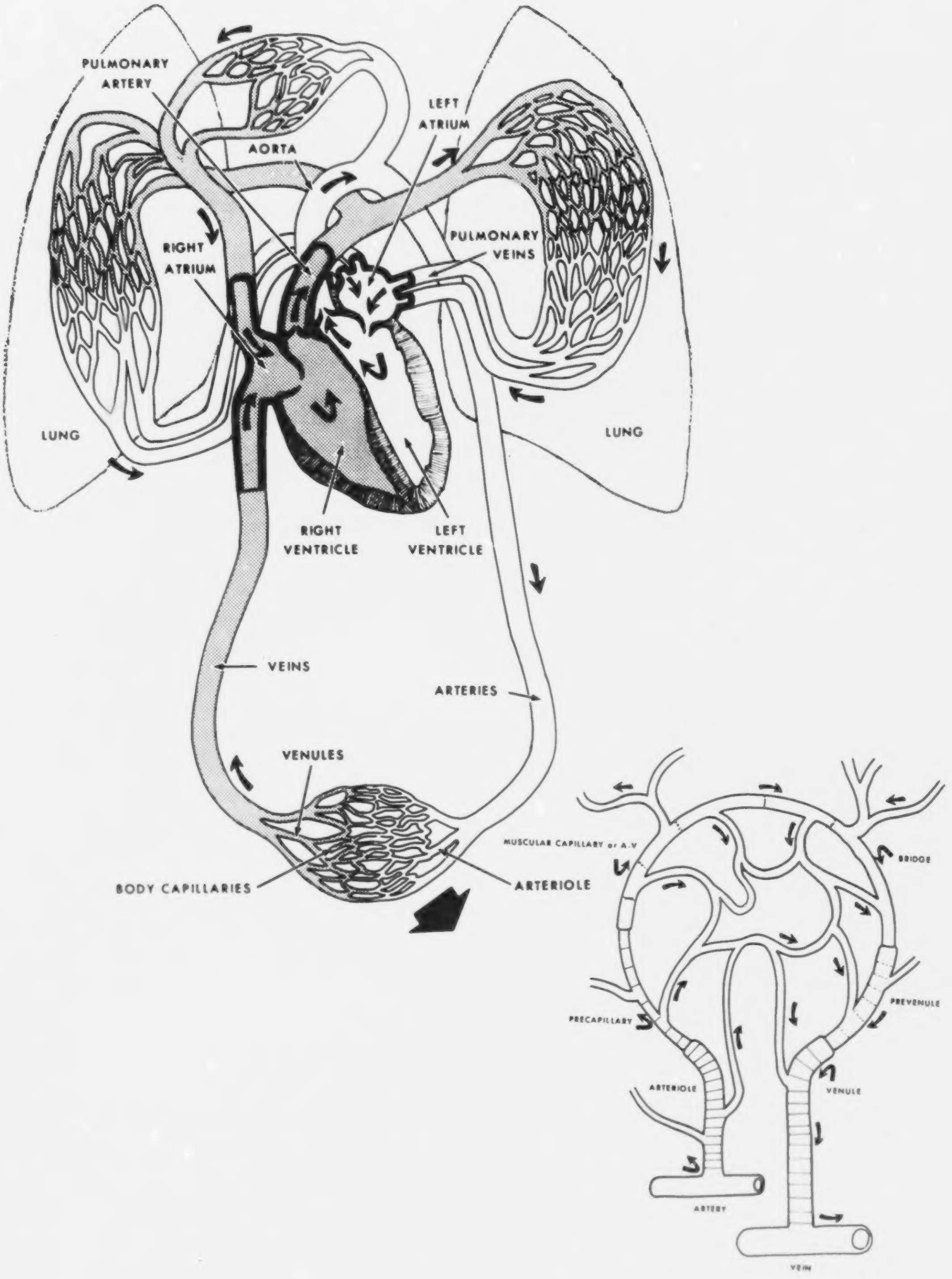

PULMONARY ARTERY
LEFT ATRIUM
AORTA
RIGHT ATRIUM
PULMONARY VEINS
LUNG
LUNG
RIGHT VENTRICLE
LEFT VENTRICLE
VEINS
ARTERIES
VENULES
MUSCULAR CAPILLARY or A.V
BODY CAPILLARIES
ARTERIOLE
BRIDGE
PRECAPILLARY
PREVENULE
ARTERIOLE
VENULE
ARTERY
VEIN

Figure 1–11. Blood circulation.

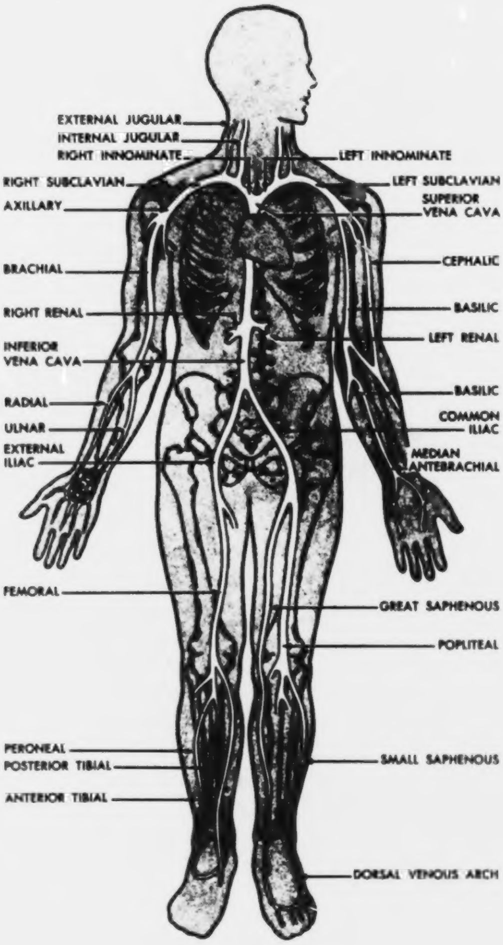

EXTERNAL JUGULAR
INTERNAL JUGULAR
RIGHT INNOMINATE
RIGHT SUBCLAVIAN
AXILLARY
BRACHIAL
RIGHT RENAL
INFERIOR VENA CAVA
RADIAL
ULNAR
EXTERNAL ILIAC
FEMORAL
PERONEAL
POSTERIOR TIBIAL
ANTERIOR TIBIAL
LEFT INNOMINATE
LEFT SUBCLAVIAN
SUPERIOR VENA CAVA
CEPHALIC
BASILIC
LEFT RENAL
BASILIC
COMMON ILIAC
MEDIAN ANTEBRACHIAL
GREAT SAPHENOUS
POPLITEAL
SMALL SAPHENOUS
DORSAL VENOUS ARCH

Figure 1-12. Major veins in the body.

effect on the bone marrow. The spleen serves as a reservoir and filter for blood. The spleen also has an immunologic function. It is the source of production of antibodies and contains a large mass of lymphatic tissue.

The *thymus* is located in the superior portion of the thoracic cavity between the aorta and sternum. Cells from the thymus eventually give rise to the cells responsible for many immunological functions of the body. The thymus is large and active in fetal and early life; however, it becomes smaller after puberty.

The *tonsils* form a protective barrier for the mouth, throat, larynx, trachea, and lungs. The protection ring of lymphatic tissue is composed of the *nasopharyngeal tonsil* (adenoids), located in the nasopharynx. The *palatine tonsils*, commonly known as the tonsils, are located in the posterior of the mouth between the anterior and posterior pillars of the fauces. The *lingual tonsils*, which are two masses of lymphatic tissue, are located on the dorsum of the tongue (see fig. 1-14).

Exercises (211):

1. The lymphatic system conveys lymph from the body tissues to the point where it reenters the ______________________ .
2. Lymph is known as ______________ fluid and is formed from ________________ ________________ .
3. How does lymph move through the lymphatic system?
4. What do lymph nodes filter?
5. List the three related organs of the lymphatic system.

1-6. Anatomy and Physiology of the Respiratory System

The respiratory system includes the structures that are concerned with the exchange of gases (oxygen and carbon dioxide). The exchange of gases within the body is known as respiration or breathing. It involves taking air into the lungs to obtain oxygen in exchange for carbon dioxide, which is exhaled. It also involves the exchange of gases at the cellular level. The body requires a constant supply and exchange of these gases to carry on the chemical processes that are vital to life. To understand this exchange of gases and how it works, you must review the related anatomy and physiology.

212. Cite the seven parts of the respiratory system, and specify the function and anatomy of these parts.

Anatomy and Physiology. The respiratory system is composed of the The ejaculatory duct. The ejaculatory duct is formed by the nose, pharynx, larynx, trachea, bronchi, lungs, and pleurae. Although the thorax is not considered part of the respiratory system nevertheless it assists in the breathing process. It is composed of the ribs, sternum, spine, diaphragm, and intercostal muscles.

Nose. The nose is a framework of bone and cartilage with an external covering of skin. The two external openings are called nostrils. Within the nose is the nasal cavity, which is divided into two parts by the nasal septum and separated from the mouth by the palate. The roof of the nasal cavity is formed from bones of the skull and face and is lined with mucous membrane. As air passes through the nasal cavity, it is warmed and moistened through contact with the mucous membrane. The air is also filtered. Large foreign particles are caught by minute hairlike structures called cilia (sill-ee-ah). By wavelike movements of the cilia, particles from the anterior part of the nose are moved to the pharynx. From here these foreign particles are either expelled from the mouth or swallowed.

The pharynx. The pharynx, or throat, is the passageway between the nasal cavity and the larynx. Figure 1-15 (the upper respiratory system) shows that the pharynx is divided

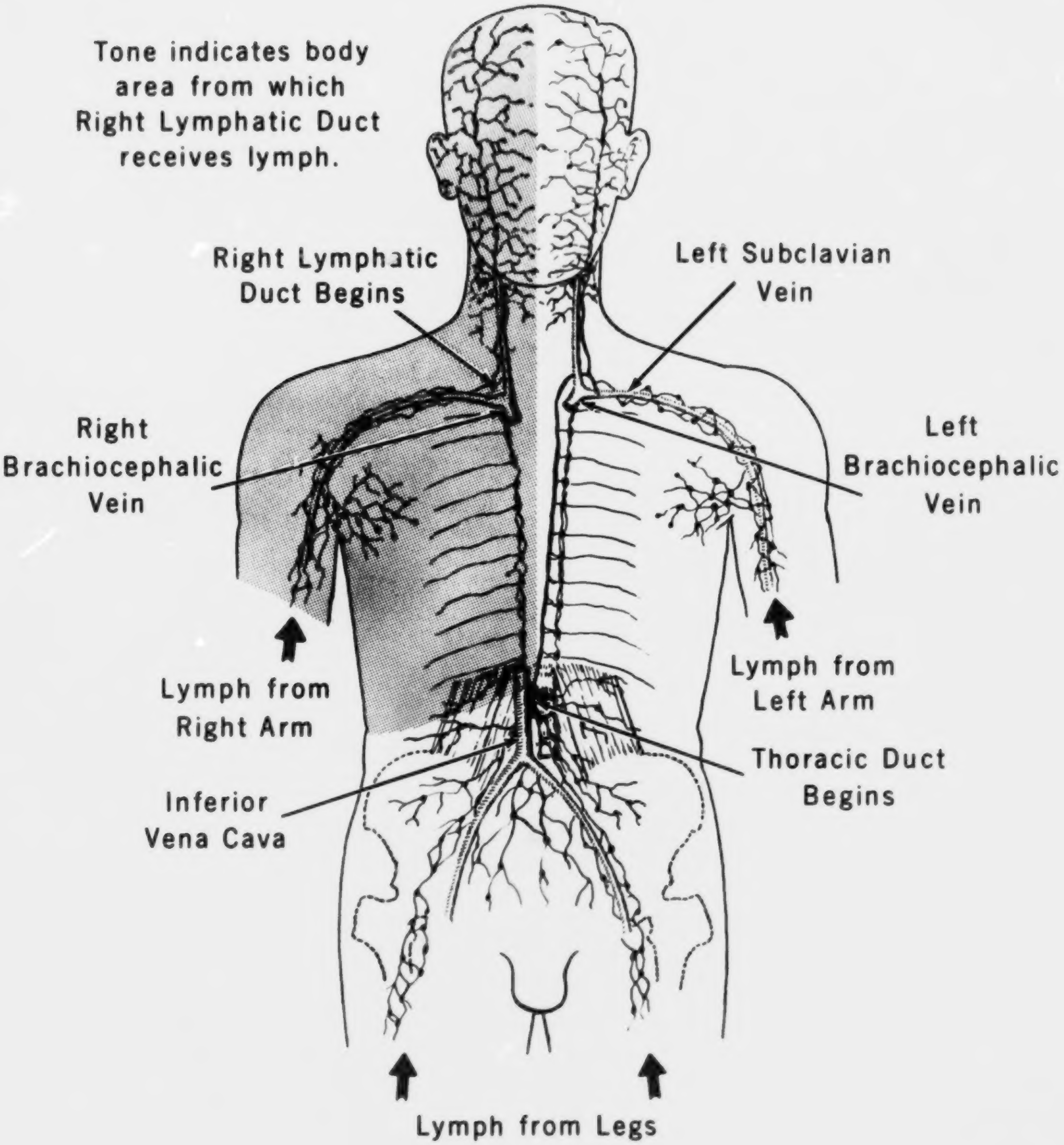

Tone indicates body area from which Right Lymphatic Duct receives lymph.
Right Lymphatic Duct Begins
Left Subclavian Vein
Right Brachiocephalic Vein
Left Brachiocephalic Vein
Lymph from Right Arm
Lymph from Left Arm
Thoracic Duct Begins
Inferior Vena Cava
Lymph from Legs

Figure 1–13. The lymphatic system.

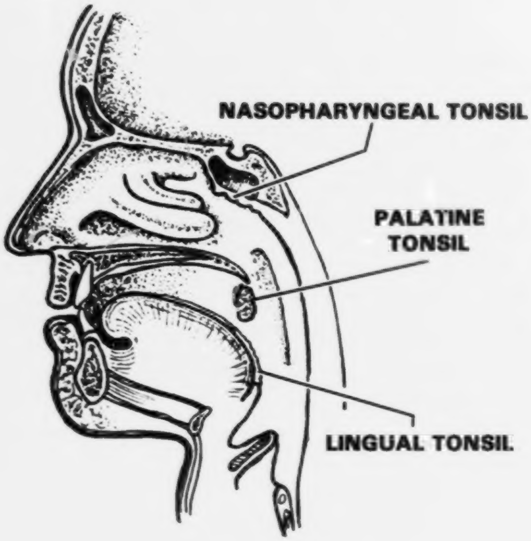


Figure 1-14. The tonsils.

into three parts—the nasopharynx, the oropharynx, and the laryngopharynx.

The nasopharynx is the superior portion of the pharynx and contains the two eustachian tubes, which communicate with the middle ear. These tubes, as shown in figure 1-15, permit the equalization of air pressure between the middle ear and the outside atmosphere. They are lined with mucous membrane that is continuous with that of the pharynx. For this reason, they provide an easy access for throat and nose infections to spread to the middle ear. This is why you sometimes get an ear infection along with a sore throat. The nasopharynx also contains a mass of lymphoid tissue called the adenoids. They are larger in children than in adults and tend to decrease in size with age. In childhood they may become infected, block the eustachian tubes, and interfere with the passage of air through the nose. They are sometimes surgically removed. Their function is a matter of debate—they are apparently nonessential to life.

The oropharynx is directly posterior to the mouth. It contains the regular or palatine tonsils. The only known function of the tonsils is the formation of lymphocytes. They often become infected and tonsillitis results. When they are removed by surgical excision, the procedure is called a tonsillectomy.

Larynx. The larynx, or "voice box," is a passageway from the pharynx to the trachea. It is a triangular, cartilaginous structure composed of nine cartilages, joined together by ligaments. It lies in the middle of the neck, between the base of the tongue and the trachea. To prevent any substance from entering the trachea during the act of swallowing, the larynx moves upward and forward so that it is positioned under the base of the tongue. This causes the epiglottis, a cartilaginous flap lying above the larynx, to move back and downward, directing the food into the esophagus. Knowing how this structure works becomes very important when caring for an unconscious or very ill patient. There is a danger that the tongue and pharyngeal tissues will relax and fall back into the oral pharynx, forcing the epiglottis down over the larynx. This causes obstruction of the airway. It can be relieved by pressing on the lower jaw and pushing it forward, keeping the teeth separated. On some occasions, it may be necessary to grasp the tongue and pull it forward. An artificial airway may be needed as an added precaution.

The larynx is made up of three single and three paired cartilages. The largest of these is the thyroid cartilage. It is shield shaped and forms the large prominence known as the Adam's apple. These cartilage landmarks are important to the physician doing surgery in the throat area.

Trachea. The trachea or windpipe extends from the larynx and terminates when it divides into the right and left bronchi (see fig. 1-16, the lower respiratory system). Note that the trachea is a cylindrical tube composed of 16 to 29 C-shaped cartilage rings. They give it firmness and prevent its collapse. The trachea is lined with cilia and mucous glands that help entrap dust and foreign matter. The cilia beat upward, moving the particles to the larynx or pharynx, where they can be removed by coughing and expelled from the body.

Bronchi. The trachea divides into two primary bronchi which convey air into the lungs. After entering the lungs, each bronchus divides and sends branches to each lobe of the lungs, three to the right lung and two to the left lung. From here, they further divide into many small bronchi called bronchioles. These bronchioles go to the alveoli, or air sacs of the lungs. The alveoli are adapted for easy passage of gases to and from the lung capillaries.

Lungs. The lungs are the primary organs of respiration. They permit the interchange of gases between the blood and the air. The lungs are contained inside the thoracic cavity and enclosed in the pleura (ploor'uh). The right lung contains three lobes; the left contains two lobes. The lungs are soft and spongy and are constantly changing their form with each respiratory movement.

Diffusion is the equalization of gases (oxygen and carbon dioxide) between the blood and air. This process takes place in the lungs. Each lung contains thousands of tiny alveoli with blood capillaries in their membrane lining. Here oxygen is exchanged for carbon dioxide. This exchange also takes place between the capillaries and the tissues of the body. Oxygen cannot be stored by the lungs or body tissue, so there is a continuous equalization or exchange of gases. Inhaled air contains about 20 percent oxygen and 0.03 percent carbon dioxide. Exhaled air contains about 16 percent oxygen and 14 percent carbon dioxide.

Pleurae. The lungs are enclosed in double-walled, serous membranes called the pleurae. Each lung has a separate pleura. The membrane or sac covering the outer surface of the lung is called the visceral layer, and the layer lining the chest wall is called the parietal layer. The area between these two membranes is called the intrathoracic or pleural space. However, this is only a potential space, since both pleural membranes are in very close contact with one

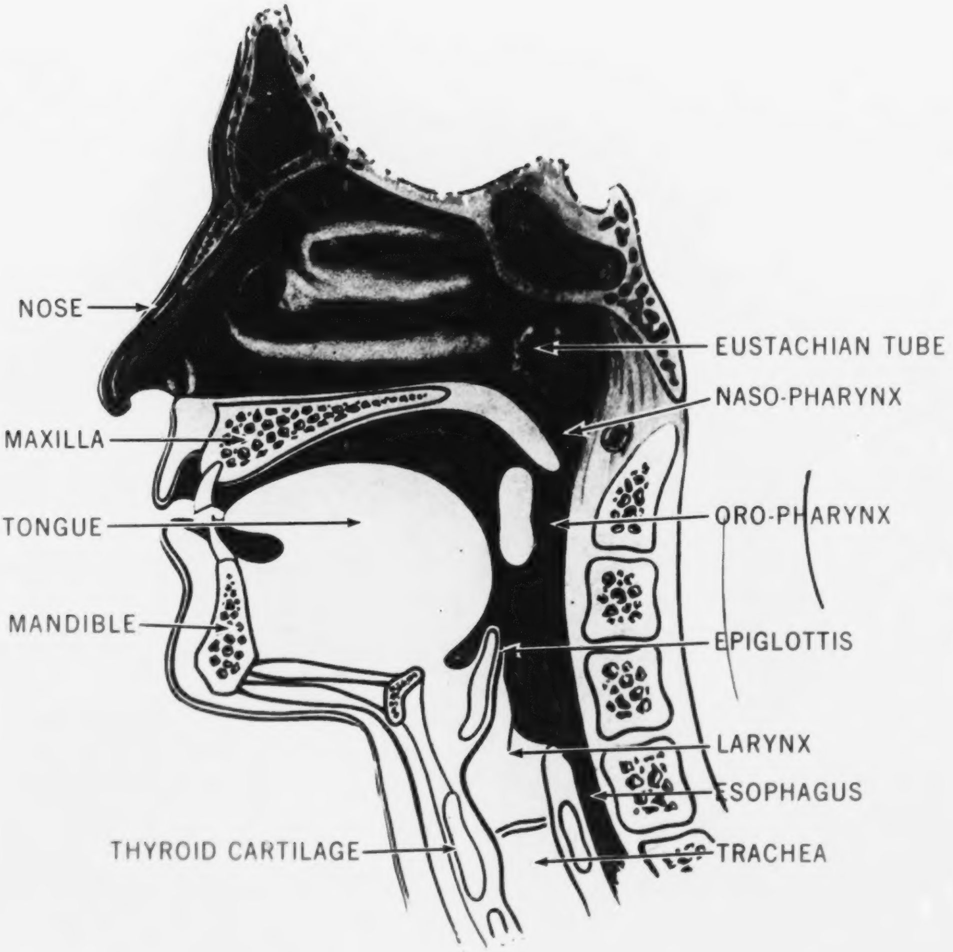

NOSE
EUSTACHIAN TUBE
NASO-PHARYNX
MAXILLA
TONGUE
ORO-PHARYNX
MANDIBLE
EPIGLOTTIS
LARYNX
ESOPHAGUS
THYROID CARTILAGE
TRACHEA

Figure 1-15. The upper respiratory system.

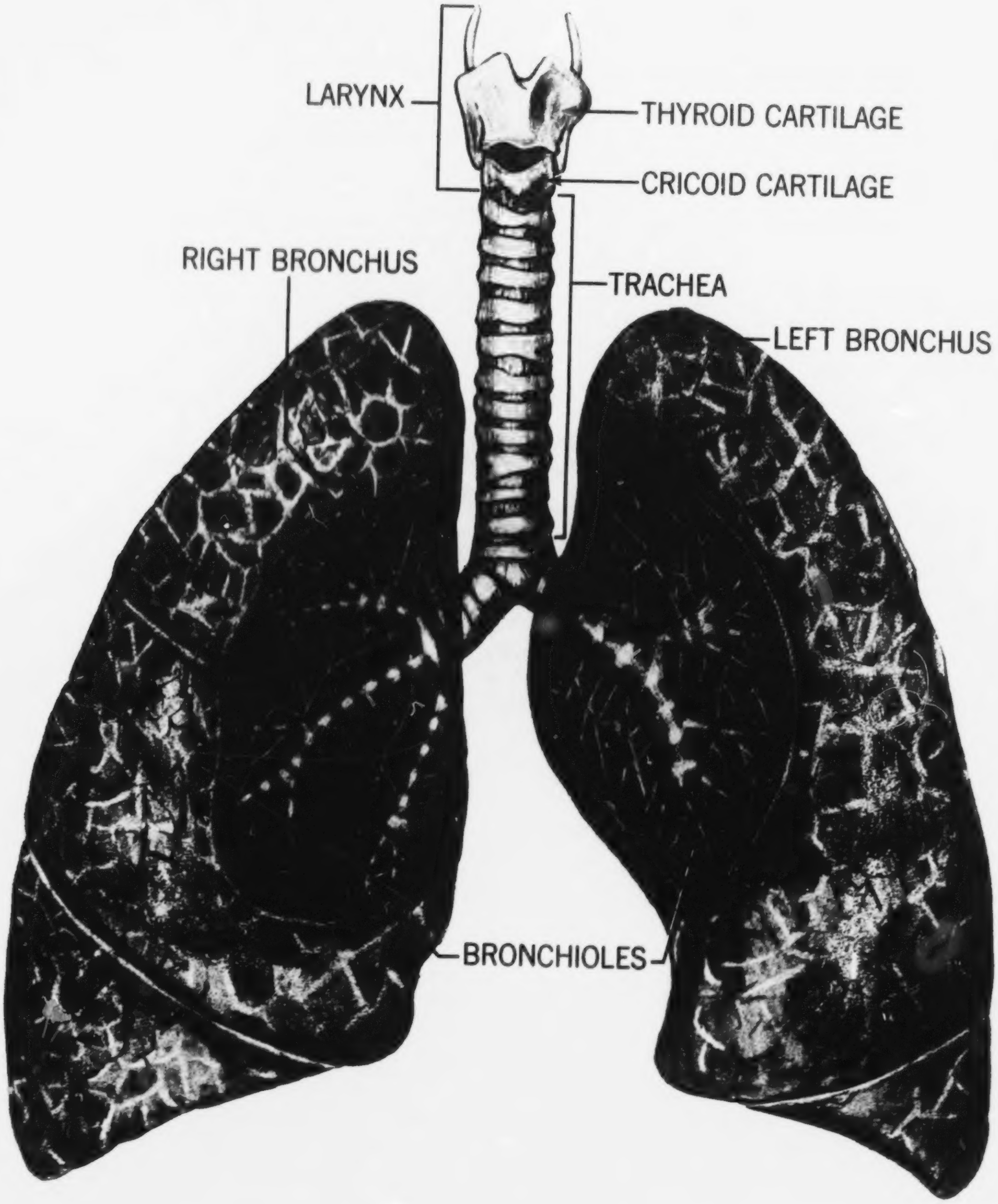

LARYNX
THYROID CARTILAGE
CRICOID CARTILAGE
RIGHT BRONCHUS
TRACHEA
LEFT BRONCHUS
BRONCHIOLES
BRONCHIOLES

Figure 1-16. The lower respiratory system.

another. The only substance separating them is a small amount of pleural fluid, secreted by the membrane. This pleural fluid reduces friction between the two pleural layers during the movements of respiration. Without this fluid a condition known as dry pleurisy results. This occurs most often in pneumonia. It results in pain because the two pleural membranes rub together during respiration.

Exercises (212):

1. Name the seven parts of the respiratory system.

2. What happens to air as it passes through the nasal cavity?

3. What function does the nasopharynx have with respect to the middle ear?

4. How does the larynx function to prevent food from entering the trachea?

5. What do the cilia and mucous glands, located in the trachea, accomplish?

6. Which part of the respiratory system permits the interchange of gases between the blood and the air?

7. Name the two layers of pleurae.

8. What does the pleural fluid accomplish?

213. Cite the mechanics of breathing.

Mechanics of Breathing. The simple process of breathing (inspiration and expiration) is far more complex than it first appears. It is a harmonious interplay of nerve impulses, muscular activity, and mechanical pressure changes, which are all influenced by chemical changes in the blood. The inflation of the lungs occurs because the muscles of respiration contract. These muscles are the diaphragm and the intercostal muscles.

In the act of inspiration, the intercostal muscles contract and help to enlarge the size of the thorax; the ribs move forward and slightly upward, increasing the front-to-back dimensions of the thorax. There is a slight increase in the side-to-side dimensions at the same time. This mechanical change, combined with the downward movement of the diaphragm, enlarges the thorax and produces a pressure decrease in the intrathoracic space—the potential space between the surface of the lungs and the internal lining of the thorax. Since the lungs are inside the thorax, and the interior of the lungs is exposed to the atmospheric pressure outside the body, atmospheric pressure forces air through the conducting passages and into the alveoli. When inspiration is complete, the muscles of inspiration relax, and because of elasticity of the chest wall and the lungs, expiration occurs.

Breathing is normally an involuntary act controlled by the nervous system. A diffuse group of nerve cells, known collectively as the respiratory center, is located in the medulla oblongata (part of the brain). The nerve impulses, which cause the muscles of respiration to contract, originate in the cells of the respiratory center. These impulses reach the respiratory muscles by two sets of nerves—the phrenic nerves and the intercostal nerves. The phrenic nerves pass down into the thorax to the diaphragm. The intercostal nerves leave the spinal cord in the upper region of the back and pass to the intercostal muscles. Nerve impulses from the walls of the alveoli return to the respiratory center through two vagus nerves that pass upward through the thorax and neck to the medulla. When the lungs are inflated and the walls of the alveoli are stretched to the maximum for the needs of the body at that particular time, nerve impulses return to the respiratory center and stop the impulses to the muscles of inspiration. Passive expiration then follows. This continuing process of inspiration and expiration is primarily involuntary and continues, even though a person is asleep or unconscious. However, there is a degree of conscious control over breathing. For example, it is possible for a person to hold his or her breath, and it is also possible for the conscious person's will to control the rate of depth of breathing. This control is from a higher voluntary center of the brain in the cerebral cortex. Impulses from these higher centers reach the involuntary respiratory center over specific nerve pathways and temporarily override its automatic function. Nerve impulses from it, then, are in accordance with the desires of the higher center. This control by the higher center is limited by chemical changes in the blood which will occur in time, and the control then reverts to the involuntary center.

Exercises (213):

Identify each true statement and explain why the others are false.

____ 1. The inflation of the lung occurs because the muscles of respiration relax.

____ 2. In the act of inspiration, the intercostal muscles contract and help to enlarge the size of the thorax.

____ 3. When inspiration is complete, the muscles of inspiration relax and, because of the elasticity of the chest wall and the lungs, expiration occurs.

____ 4. Breathing is normally a voluntary act controlled by the nervous system.

____ 5. The nerve impulses which cause the muscles of respiration to contract originate in the cells of the phrenic nerve.

____ 6. The ability to control the rate and depth of breathing is from a higher voluntary center of the brain in the cerebral cortex.

1-7. Anatomy and Physiology of the Digestive System

The digestive system is highly complex. It is approximately 28 feet long, extending from the mouth to the anus. Most of this digestive tract is contained in the abdominal cavity, a space between the diaphragm and the pelvis. The abdominal cavity is lined with a serous membrane called the peritoneum (per-i-toe-nee'-um). It holds the abdominal and pelvic organs in place and also secretes a fluid that lubricates the abdominal organs, preventing friction. The digestive system is divided into two separate division—the alimentary canal and the accessory organs of digestion. The entire system includes all the organs concerned with the ingestion of food, its absorption, and the nutrition of all of the cells of the body.

214. Cite the location and specify the functions of the different sections of the alimentary canal.

The Alimentary Canal. The alimentary canal includes the mouth and its structures, the pharynx, the esophagus, the stomach, the small and large intestines, the rectum, and the anus. It is lined with mucous membranes, which provide a smooth, moist surface for the passage of food.

Mouth. The mouth receives food and is the beginning of the alimentary canal. Here digestion of food begins. Food is softened, mixed with saliva, and chewed to start the digestive process (see fig. 1-17).

Esophagus. The esophagus is a muscular tube about 10 inches long and about 1/2 to 1 inch in diameter. Look again at figure 1-17 and note that it extends from the end of the pharynx to the stomach. It lies between the trachea and the vertebrae. Gravity and peristalsis (per-i-stal'-sis) move food downward through this tube into the stomach.

Stomach. The stomach is a saccular enlargement of the gastrointestinal tract that stores and digests food. It is located in the upper left quadrant of the abdomen just below the diaphragm. Two muscular rings or sphincters guard the entrance to, and the exit from, the stomach. The cardiac sphincter at the upper end of the stomach opens and allows food to enter from the esophagus, and the pyloric sphincter at the lower end controls the entry of food into the duodenum (doo-oh-dee'-num), the beginning of the small intestines.

The upper border of the stomach is called the small or lesser curvature, and the lower border is called the greater curvature (see fig. 1-18). Locate these curvatures as well as the sphincters. Falling from the lower or greater curvature of the stomach is an apronlike structure of fat called the greater omentum. The greater omentum is a special tissue located anterior to the intestine. It forms a cushion for these organs as well as a storage place for fat. It also prevents infection from spreading by matting itself around an infected area. Look again at figure 1-18 and locate these three anatomical parts of the stomach: the fundus, the body, and the pylorus.

Numerous tiny glands in the stomach secrete gastric juice containing enzymes and hydrochloric acid. This gastric juice starts protein digestion. The hydrochloric acid also acts as a disinfectant to destroy any bacteria which may have been taken in with the food. Food remains in the stomach for 3 to 4 hours while peristalsis churns and thoroughly mixes the food with the gastric juices. The result is a semiliquid substance called chyme (kime). Chyme is released through the pyloric sphincter into the duodenum where further digestion takes place. Some drugs, concentrated sugar, and alcohol are absorbed by the stomach, all in small amounts.

Small intestine. The small intestine is a much-coiled, muscular tube, about 20 feet long. It consists of three parts: the duodenum, the jejunum (je-joo-um), and the ileum. The intestine is attached to the posterior abdominal wall by mesentery (meh'-zehn-ter'-ee). Mesentery is a special type of tissue that is gathered together like a folding fan, permitting coiling of the intestine so that this organ can be contained in a small space. Examine figure 1-18 and locate the three parts of the small intestine.

The duodenum is the first and shortest part of the small intestine. It is about 9 to 12 inches long and forms a C-shaped curve just below the liver and around the head of the pancreas. The duodenum is lined with special glands that secrete intestinal juices. The bile and pancreatic ducts open into the duodenum. These ducts carry secretions from the liver, pancreas, and gallbladder. These secretions are combined with those produced by the duodenum. They aid in the digestion of food by converting it to simple sugars, amino acids, fatty acids, and glycerol (glih'-sur-awl).

The jejunum is the middle part of the small intestine. It is almost 8 feet in length and extends from the duodenum to the ileum (ill'-ee-um). Minor food absorption takes place here.

The ileum is the last and longest part of the small intestine. It extends from the jejunum to the large intestine. It is 10 to 12 feet in length. Most food absorption takes place here. The ileum is lined with fingerlike processes called villi (vill'-eye). The villi are outgrowths from the mucosa or interstitial lining which provide a larger absorption area. They also contain lymph channels and a network of blood capillaries. After food has been digested, it is absorbed into the capillaries and lymph channels and carried to all parts of the body. Material that cannot be digested and absorbed passes through the ileocecal valve into the large intestine.

Large intestine. The large intestine, often called the colon, consists of the cecum (see'-kum), ascending colon, transverse colon, desending colon, sigmoid colon, and the rectum. The large intestine is about 5 feet in length and about 2 inches in diameter. It absorbs water from the liquid contents it receives. Glands in its walls secrete mucus that mixes with the remaining material and helps to form the stool, or feces.

The cecum is the first part of the large intestine. It is a blind pouch situated in the right lower abdomen below the

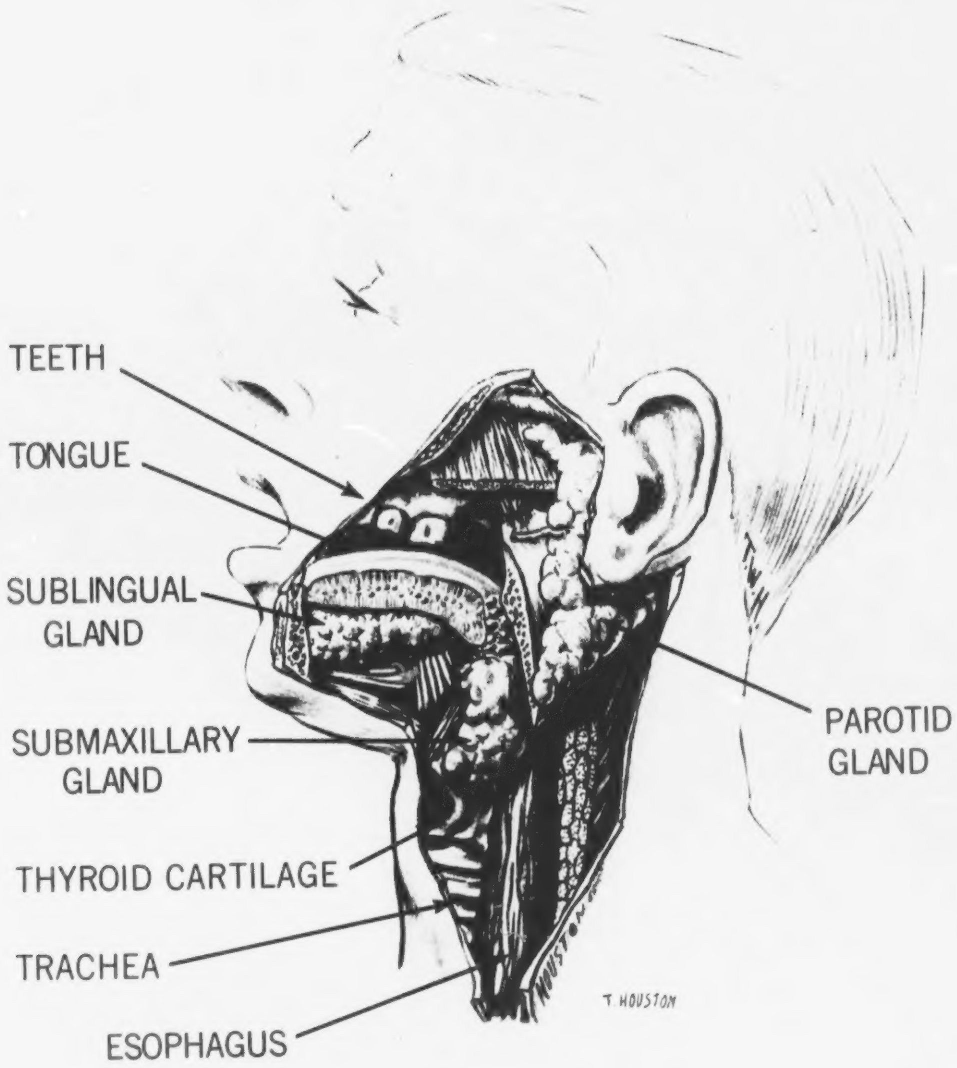

TEETH
TONGUE
SUBLINGUAL GLAND
SUBMAXILLARY GLAND
THYROID CARTILAGE
TRACHEA
ESOPHAGUS
PAROTID GLAND
T. HOUSTON

Figure 1–17. The upper alimentary tract.

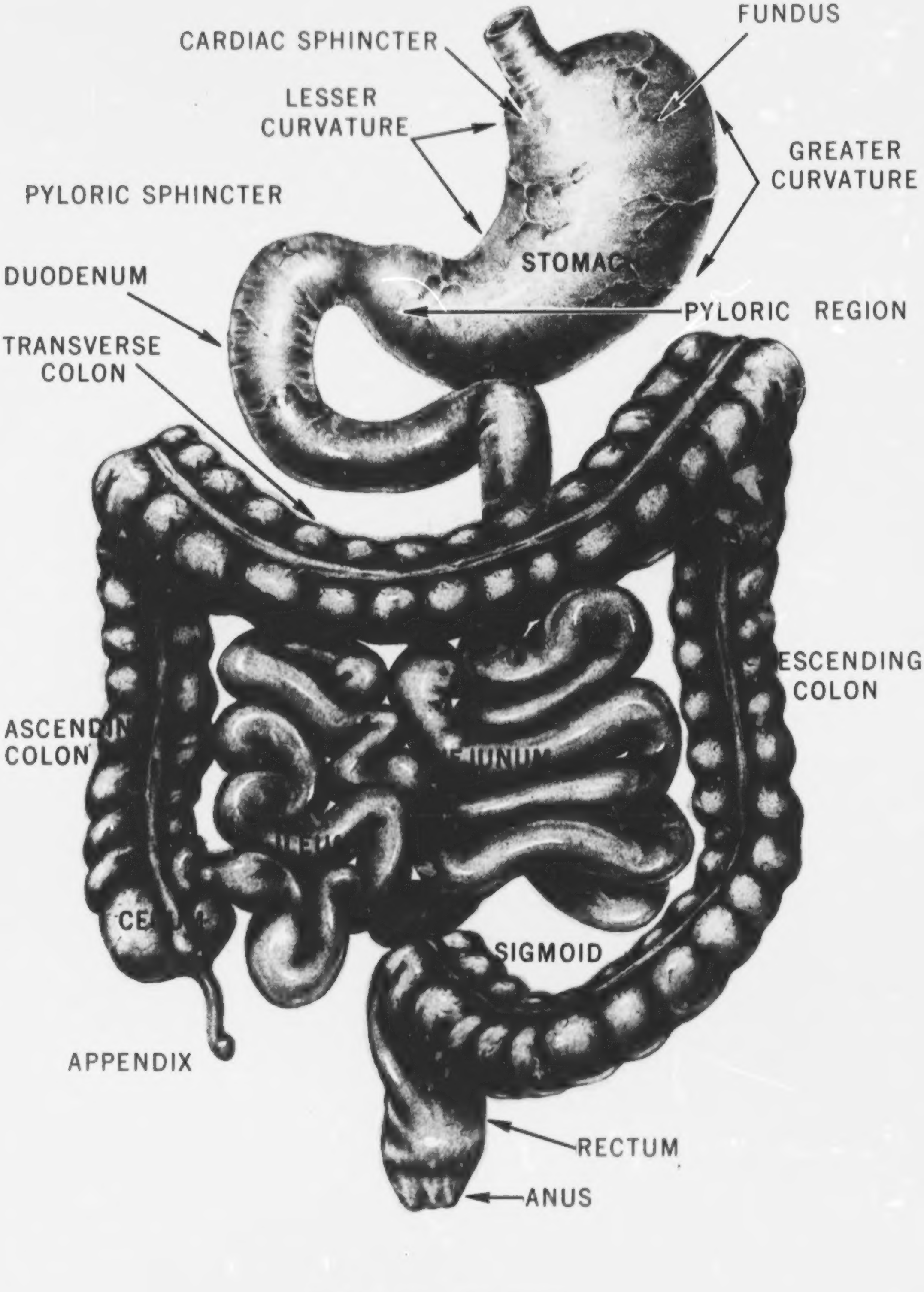

FUNDUS
CARDIAC SPHINCTER
LESSER CURVATURE
GREATER CURVATURE
PYLORIC SPHINCTER
STOMACH
DUODENUM
PYLORIC REGION
TRANSVERSE COLON
ESCENDING COLON
ASCENDIN COLON
JEJUNUM
ILEUM
CECUM
SIGMOID
APPENDIX
RECTUM
ANUS

Figure 1-18. The stomach and intestines.

ileocecal valve. Refer to figure 1-18 for these important landmarks. The ileocecal valve is a one-way valve that controls the passage of materials into the cecum from the ileum. The cecum is only 3 to 4 inches in length. Attached to the end of the cecum is the appendix, a long, slender tube with a blind end. The appendix has no known function but does become infected occasionally, and the resulting inflammation is known as appendicitis.

Refer to figure 1-18 again and follow the ascending colon up from the cecum to the transverse colon on the right side of the abdomen. The transverse colon extends across the abdominal cavity, turns downward, and becomes the descending colon. The descending colon extends in front of the left kidney to the pelvis. At the level of the crest of the ileum it makes an "S" turn and forms the sigmoid colon. It then passes through the pelvis and becomes the rectum. The rectum passes downward in a curve formed by the sacrum and coccyx and ends in the lower end of the alimentary tract as the anus. The anus is the external opening at the lower end of the digestive tract. Except during bowel movement, it is kept closed by a strong muscular ring, the anal sphincter.

Exercises (214):

1. Where is the esophagus located?

2. Where, in the abdomen, is the stomach located?

3. What is the function of the stomach?

4. Cite the functions of the greater omentum.

5. Name the first and shortest span of the small intestine.

6. Where does the majority of food absorption take place?

7. What is the function of the ileocecal value?

8. Except during bowel movement, what keeps the anus closed?

215. Specify the functions of the accessory organs of digestion.

The Accessory Organs of Digestion. The accessory organs of digestion include the liver, the gallbladder, the pancreas, and the salivary glands. The first three are shown in figure 1-19. Each of these organs plays an important role in the digestion of food. We will consider each of them separately.

Liver. The liver, the largest glandular organ in the body, is located in the right upper quadrant of the abdomen just below the diaphragm. It is a very vascular (containing many blood vessels) gland divided into two primary lobes. Each lobe has a duct for collecting bile. The ducts join together in each lobe and leave the liver as the hepatic duct. The hepatic artery and vein furnish a rich supply of blood to the liver. All blood from the stomach and small intestines passes through the liver by means of the portal vein.

The liver is one of the wonders of the body. Some of its vital functions are as follows:

a. Aids in the metabolism of carbohydrates, proteins, and fats.

b. Makes and secretes bile (bile emulsifies fat, an essential process before fats can be digested).

c. Helps to maintain the proper level of sugar in the blood by changing glucose into glycogen, storing it, then changing it back to glucose when it is needed.

d. Makes plasma, proteins, and antibodies.

e. Stores vitamins A and D and some minerals.

f. Produces heparin and fibrinogen which influence clotting of blood.

g. Destroys wornout red blood cells.

h. Detoxifies substances which might be harmful, such as the end product of protein digestion.

i. Produces heat.

Gallbladder. The duct system of the liver transports bile from the liver cells to the duodenum or to the gallbladder for storage. The gallbladder is a reservoir for concentrating and storing bile. It is about 3 to 4 inches long and has a capacity of about 50 cc. The gallbladder is a pear-shaped, hollow sac located on the underside of the liver. Its duct, the cystic duct, joins the hepatic duct from the liver to form the common bile duct, which enters the duodenum at the ampulla of vater. When food arrives in the duodenum, the gallbladder contracts and bile is sent through the cystic duct into the common bile duct and into the duodenum.

Pancreas. The pancreas is a vascular organ with its body or main part lying below the liver and the stomach and adjacent to the duodenum. Its "tail" extends transversely to the left and terminates near the spleen. The pancreas provides pancreatic juice and the hormone, insulin.

Salivary glands. The salivary glands contribute to the production of saliva, which has several important functions. First, saliva moistens and lubricates the mouth cavity, making speaking and swallowing easier. It also helps to keep food particles together and acts as a cleaning agent for the mouth, and as we mentioned before, the salivary glands initiate the process of digestion.

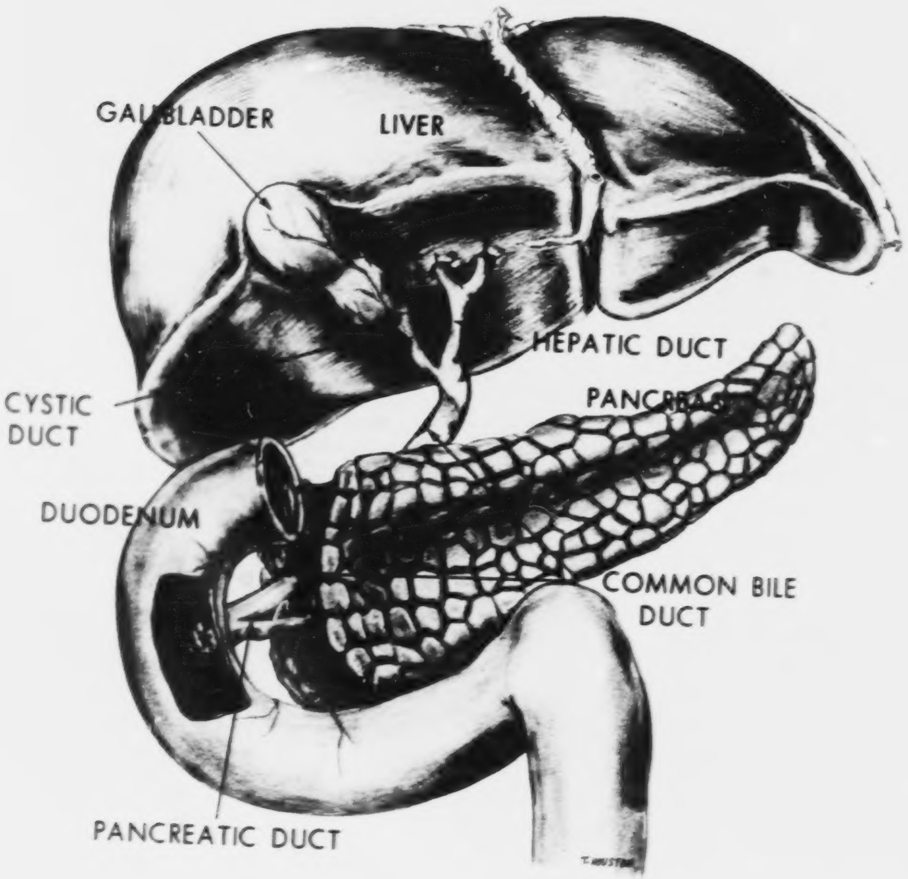


Figure 1-19. Accessory digestive organs.

Exercises (215):

1. Match the functions listed in column A with the correct item listed in column B. One of the items in column B will be used more than once.

Column A

____ (1) Makes and secretes bile.
____ (2) Serves as a reservoir for storing bile.
____ (3) Makes plasma, proteins, and antibodies.
____ (4) Provides insulin.
____ (5) Stores vitamins A and D.
____ (6) Initiates the process of digestion.

Column B

a. Pancreas.
b. Salivary glands.
c. Liver.
d. Gallbladder.

1-8. Anatomy and Physiology of the Nervous System

The nervous system is the stimulus—response mechanism that coordinates and regulates all body activity. It is responsible for all the processes that make the adjustment to both internal and external environment and is the most highly organized system in the body. It may be considered as an intricate communications system that transmits impulses from different parts of the body to the brain and from the brain to organs and structures that react to impulses.

The nervous system is both voluntary and involuntary and is composed of the brain, spinal cord, nerves, and ganglia (gang'-lee-ah). It is divided into a central nervous system (CNS) and a peripheral nervous system (PNS). The peripheral nervous system also includes the autonomic nervous system, which is self-controlling and is formed from the many nerves that innervate the internal organs, glands, and blood vessels. We will examine each of these systems later on, but first we will consider the structure of the nervous system.

216. Specify the two types of neurons and list what each type does.

Structure of the Nervous System. The basic structural unit of the nervous system is the neuron or nerve cell. Each neuron contains a cell body and cell processes called dendrites and axons. Dendrites carry impulses toward the cell body, and axons carry impulses away from the cell body. A typical nerve cell is shown in figure 1-20. There are two types of neurons—afferent (which is receptive or sensory) and efferent (which is effective or motor). Afferent neurons carry impulses from the periphery (body) toward the spine and brain. Efferent neurons carry impulses from the brain and spine to the periphery. The bodies of afferent neurons are located in ganglia, just outside the spinal cord. A ganglion is a group or mass of neurons that serves as a center of nervous impulses.

A nerve is a cordlike structure that transmits impulses from one part of the body to another. A nerve has many fibers that are closely associated but have independent functions. A nerve may consist of sensory fibers only, motor fibers only, or a combination of the two.

Exercises (216):

1. Identify the two types of neurons.

2. What is the function of afferent neurons?

3. What is the function of efferent neurons?

217. Specify the structure and function of various parts of the central nervous system.

The Central Nervous System. The central nervous system is composed of the brain and spinal cord and is located inside the cranial cavity and in the vertebral canal. To help you to understand both structures, we will consider them separately.

The brain. The brain, shown in figure 1-21, receives and interprets impulses from stimuli and sends out responses for action. It is composed of a large mass of nerve tissue and has three main parts—the cerebrum, the cerebellum, and the brain stem. These are discussed individually in the following paragraphs.

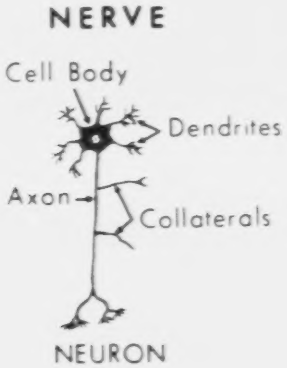


Figure 1-20. A typical nerve cell.

Cerebrum. The cerebrum (or forebrain) is the largest part of the brain and is divided into right and left halves called hemispheres. Each hemisphere is divided into specialized lobes, named after the cranial bones to which they are joined. Each of these lobes is a specialized, functional area. The frontal lobe is a motor area; the parietal lobe is a sensory area, the occipital lobe is the center of vision, and the temporal lobe is the center of hearing.

The cerebrum, shown in figure 1-21, presents a wrinkled appearance, characterized by many ridges and convolutions. The outer layer of the cerebrum, called the cortex, is made up of gray matter containing nerve cells. It governs all conscious functions. The interior of the cerebrum is white and contains bundles of axons and nerve tracts. Its functions include the accumulation and storage of knowledge, or memory, and the interpretation of sensations.

Cerebellum. The cerebellum is the second largest part of the brain and is located in the lower posterior part of the cranial cavity, beneath the cerebrum. Its primary functions are concerned with the coordination of muscular movements and body balance, or equilibrium.

Brain stem. The brain stem consists of three functional parts: the midbrain, the pons, and the medulla oblongata. The midbrain is a small structure containing nuclei for reflex control. The pons makes up the middle part of the brain stem and serves as a bridge to connect the brain stem to the cerebellum. It also serves as a place for the exit of cranial nerves and helps to regulate respiration. The medulla oblongata is the part of the brain that connects with the spinal cord. It is the location of such vital control centers as respiration, heartbeat, and blood pressure. In addition, many reflex actions such as sneezing, coughing, and peristaltic movement are controlled by the medulla oblongata.

The spinal cord. The spinal cord is the main nerve trunk for the body. It is similar to a large telephone cable, able to carry hundreds of messages at the same time. It is located inside the vertebrae column, extending from the brain to the lower region of the back, and it is the means by which impulses from the brain reach the periphery of the body, and also it is the way by which impulses from the periphery reach the brain. The spinal cord contains 31 pairs of spinal nerves with both sensory and motor fibers that lead from the cord to all parts of the body.

The brain and spinal cord are covered with three layers of special membranes called meninges (men-in'-jeez). Meninges serve as a protective covering for the brain and spinal cord. The space between the middle and inner layers contains cerebrospinal fluid, a clear watery solution similar to blood plasma. It circulates over the entire surface of the brain and spinal cord and provides a protective cushion as well as a source of nourishment for these structures. It is continuously being formed by a plexus (network or mass) of blood vessels in the brain and, as it is formed, a like amount is continuously reabsorbed.

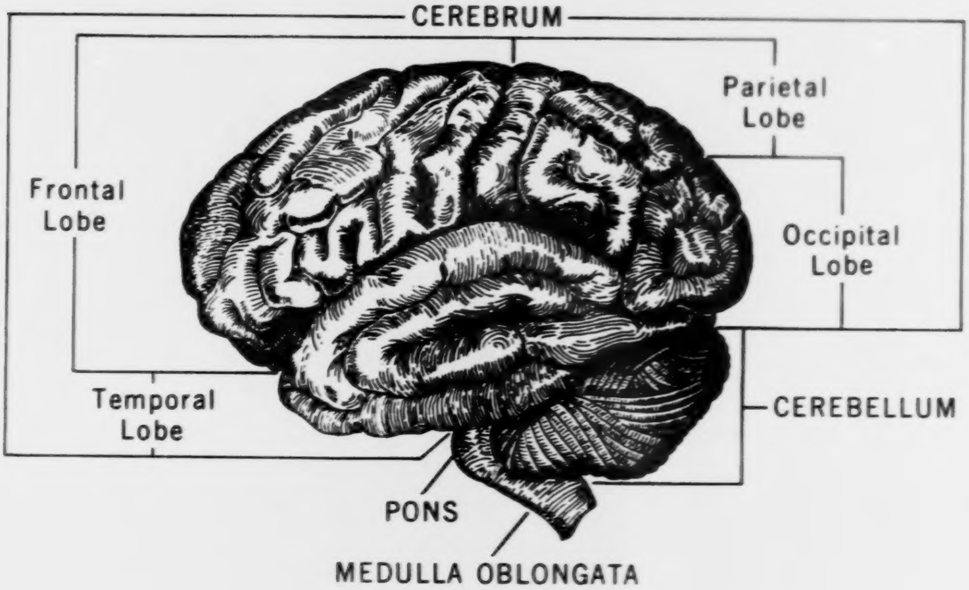


Figure 1-21. The brain.

Exercises (217):

Identify each true statement and explain why the others are false.

____ 1. The central nervous system is composed of the brain and the spinal cord.
____ 2. The cerebrum is divided into right and left halves called hemispheres.
____ 3. The frontal lobe of the cerebrum is a sensory area.
____ 4. The cortex governs all conscious functions.
____ 5. The cerebellum is the largest part of the brain.
____ 6. The pons make up the middle part of the brain stem.
____ 7. Sneezing, coughing and peristaltic movement are controlled by the medulla oblongata.
____ 8. The spinal cord contains 23 pairs of spinal nerves.

218. Identify the nerves of the peripheral nervous system.

The Peripheral Nervous System. The peripheral nervous system is made up of 12 pairs of cranial nerves and 31 pairs of spinal nerves stemming from the brain and spinal cord, respectively. These nerves carry both voluntary and involuntary impulses. The cranial nerves are sensory, motor or mixed. They are discussed in the following paragraphs.

a. The olfactory nerves convey the sensation of smell from the mucosa of the nose to the olfactory center of the brain.

b. The optic nerves are concerned with vision. They convey the sensation of sight from the receptor cells in the retina of the eye to the visual area in the posterior aspect of the occipital lobe of the cerebrum.

c. The oculomotor nerves control the movements of the eye muscles. To a lesser degree, they are concerned with the

d. The trigeminal nerves, whose branches include the ophthalmic nerve, the maxillary nerve, and the mandibular nerve, innervate the eye and oral cavity.

e. The trochlear nerves control the superior oblique muscles of the eye.

f. The abducens nerves control the lateral rectus muscles of the eye.

g. The facial nerves control the muscles of the face that are concerned with facial expression.

h. The acoustic nerves consist of two nerve roots—the cochlear and the vestibular. The cochlear root is concerned with hearing, and the vestibular root with equilibrium or balance.

i. The glossopharyngeal nerves supply the tongue and pharynx and convey taste sensations from the tongue to the cerebrum.

j. The vagus nerve extends through the neck to the pharynx, larynx, trachea, and esophagus. This nerve has wide distribution in the thoracic and abdominal viscera. It also influences heart rate, breathing, speech, and swallowing.

k. The spinal accessory nerves supply the two muscles of the neck—the trapezius and the sternocleidomastoideus.

l. The hypoglossal nerves control the muscles of the tongue.

These nerves also may be referred to by number. For instance, the olfactory nerve may also be called the first cranial nerve and the acoustic nerve, the eighth cranial nerve.

The spinal nerves are mixed nerves that arise from the spinal cord and pass through the intervertebrae formina. There are 31 pairs: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal. They interlace in some regions of the body and also form a plexus. These plexuses are found in the cervical, bracheal, lumbar, and sacral regions.

The autonomic nervous system belongs to the peripheral nervous system, and it is functional rather than organic. It is formed from the many nerves that innervate the internal organs, glands and blood vessels. Its action, as the name implies, is automatic. The autonomic nervous system enables the body to maintain an internal environment suitable for all vital body processes. It is further divided into a sympathetic and a parasympathetic system. These two systems act in opposition to each other. For example, the sympathetic system stimulates nerves that cause acceleration of the heart beat and raise the blood pressure. The parasympathetic system acts to slow the heart and lower the blood pressure. By acting in opposition, the two opposing functions tend to keep the body in delicate balance.

Exercises (218):

1. Match the nerves in column A with the apropriate statement that describes them in column B.

Column A

____ (1) Olfactory nerves.
____ (2) Optic nerves.
____ (3) Oculomotor nerves.
____ (4) Trigeminal nerves.
____ (5) Facial nerves.
____ (6) Vagus nerve.
____ (7) Hypoglossal nerve.
____ (8) Glossopharyngeal nerves.
____ (9) Spinal accessory nerves.

Column B

a. Control the muscles of the tongue.
b. Control the movements of the eye muscles.
c. Include the ophthalmex, maxillary, and mandibular nerves.
d. Convey the sensation of smell.
e. Control the muscles of the face concerned with expression.
f. Concerned with vision.
g. Influences heart rate, breathing, and speech.
h. Supply motor sensation to the trapezuis muscle of the neck.
i. Convey taste from the tongue to the cerebrum.

1-9. Anatomy and Physiology of the Excretory System

The excretory functions of the body are carried out by the kidneys, which excrete liquid and soluble water products; the skin, which excretes water and dissolved salts; the digestive tract, which excretes solid wastes; and the lungs, which excrete carbon dioxide and water.

219. Cite the location, parts, and functions of the urinary structure.

The Urinary System. The urinary system, as shown in figure 1-22, is composed of the kidneys, ureters, bladder, and urethra. It maintains the water balance of the body and removes the waste products of metabolism from the blood and excretes them from the body.

The kidneys. The kidneys are composed of two large, bean-shaped organs that lie on the posterior abdominal wall just below the diaphragm and on either side of the vertebrae column. The renal glands lie on the superior surface of the kidneys. Refer to figure 1-23 as we discuss the different parts of the kidneys. The medial surface of the kidney is concave. The notch in this surface is called the hilum. Through the hilum, the renal artery, vein, nerves, and lymphatic vessels enter and leave the kidney. The functioning renal unit is the nephron (nef'-ron), which consists of a renal corpuscle and its tubule. Each kidney contains about 1 million nephrons. Only about 25 percent of the total renal mass is essential for the survival of the individual.

Urine formation is the result of two processes: filtration, which takes place in the renal corpuscle; and reabsorption, which occurs in the tubules.

The ureters. The ureters are the tubes which connect the kidneys with the urinary bladder. Peristaltic contractions of the ureters aid in transporting urine to the bladder.

The urinary bladder. The urinary bladder lies in the pelvis, with its neck just posterior to the symphysis pubis. The urinary bladder stores urine prior to excretion.

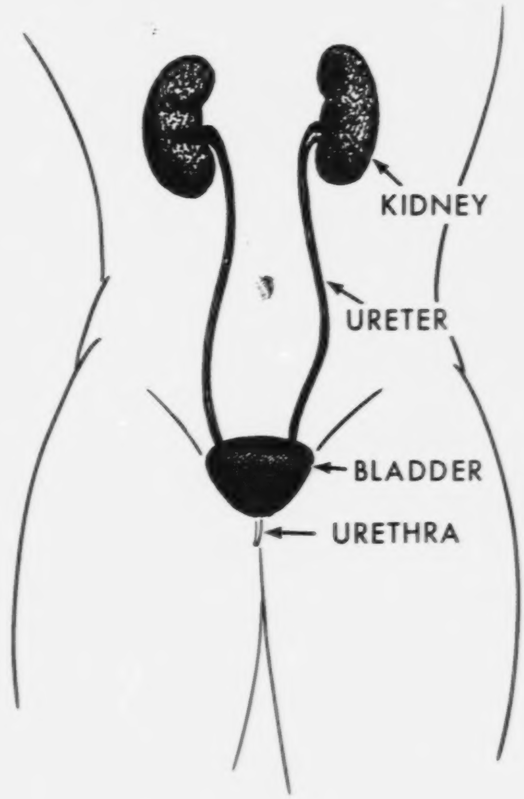


Figure 1-22. The urinary system.

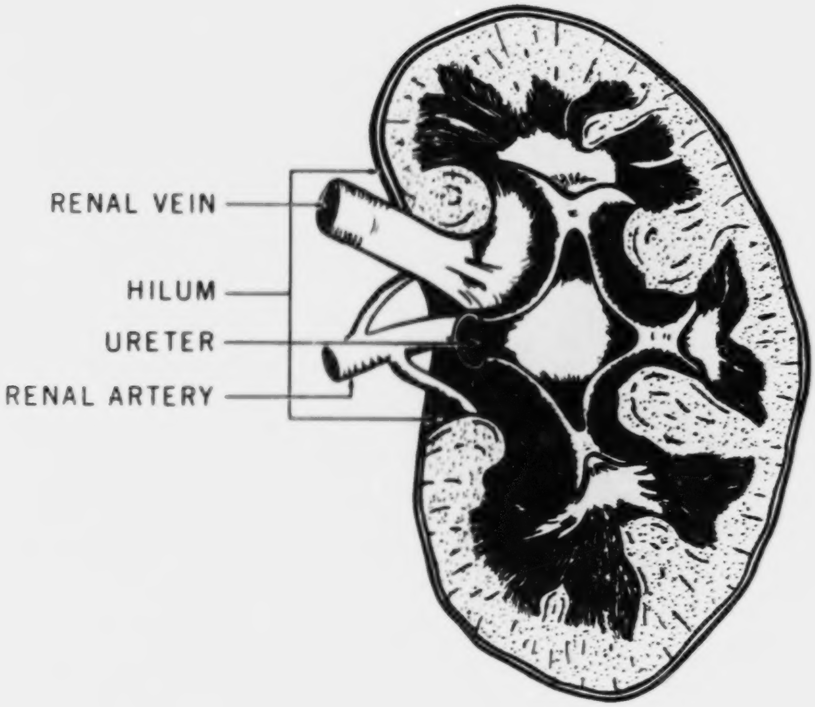


Figure 1-23. Parts of the kidney.

The urethra. The urethra is the tube passing from the bladder to the exterior of the body. The female urethra is about 4 cm long, while the male urethra is about 20 cm long.

Exercises (219):

Place the letter "T" in front of correct statements.

____ 1. The kidneys are two bean-shaped organs located on the anterior abdominal wall.
____ 2. The function of the bladder is to store urine prior to excretion.
____ 3. The length of the female urethra is about 20 cm long.
____ 4. About 25 percent of the total renal mass is essential for the survival of the individual.
____ 5. Urine is the result of the filtration and destruction processes.
____ 6. Peristaltic contractions aid in transporting urine to the bladder.

220. Specify the functions of the skin as it relates to the excretory system.

The Skin. The skin serves many functions. It is sensitive to pain, temperature, touch and pressure. It forms an elastic and rugged covering for protection against the external environment, and it also inhibits excessive loss of water, essential fluids, and salts.

Heat loss is regulated by nervous and chemical activation of the sweat glands located in the skin and by dilation and contraction of capillary vessels. The skin has a minor secretory function in that it secretes sebum (see'-bum), which is the oily substance primarily responsible for the lubrication of the surface of the skin. Through the sweat glands of the skin, water and dissolved salts are excreted from the body.

Exercises (220):

1. What are the two functions of the skin?

2. What is the purpose of sebum?

3. How is heat loss regulated?

1-10. Anatomy and Physiology of the Endocrine System

As mentioned previously, the body is a complex, amazing structure in that so many of its components interrelate and influence the activities of other parts. You have already learned about the work of the pancreas in its secretion of digestive chemicals. The pancreas also performs endocrine functions. Most endocrine glands, however, do not perform both endocrine and exocrine functions. This section briefly describes the various glands and their functional influence on the body.

221. Identify the functions of the major glands of the endocrine system, and relate the cause of diabetes mellitus.

Glands of the endocrine system are located in various parts of the body, as shown in figure 1-24. The functions of the glands also vary in the activities they perform.

The Pituitary. This is a small, pea-sized gland that is located at the base of the brain. It has control over all other endocrine glands of the body. It is divided into the anterior and posterior lobes.

(1) The anterior lobe influences skeletal growth; thyroid secretions and activity of the adrenal cortex.

(2) The posterior lobe inhibits water excretion by the kidneys; stimulates contraction of smooth muscles; secretes oxytocin, the principal uterine—contracting and lactation—stimulating hormone of the gland.

The Thyroid. The thyroid's two lobes lie on the anterior part of the neck below the larynx. It is connected to the upper trachea by a thin strip of tissue called the isthmus. The thyroid secretes the hormone thyroxin, which controls the metabolic rate of the body. This includes the rate of physical growth, mental development, sexual maturity, and in the distribution and exchange of water and salts in the body.

The Parathyroids. These are small, round bodies, usually four in number, located behind the thyroid. Their hormones regulates the calcium and phosphorus content of the blood and bones.

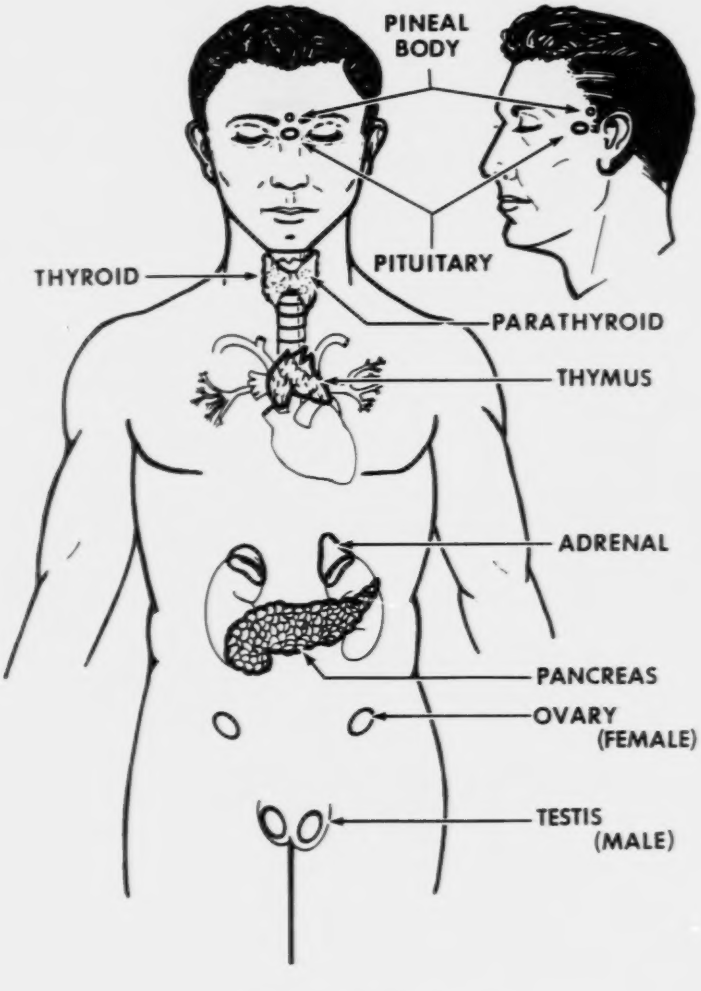


Figure 1-24. The endocrine system.

The Adrenals. The two adrenal glands sit like caps, one on the top of each kidney. They consist of the outer portion (cortex) and the inner portion (medulla). The adrenal cortex secretes numerous compounds that control salt and water balances and affect the body's ability to meet stress and resist infection. The medulla secretes epinephrine. Epinephrine stimulates the autonomic nervous system and influences arterial blood pressure and heart beat; relaxes the coronary arteries; causes contraction of uterine and bronchial muscles; causes dilation of the eyes; elevates blood sugar; and generally increase the metabolic rate.

The Gonads. These are the ovaries in the female and the testes in the male. Gonads are located in the pelvic area. The ovaries are located in the pelvis, one on each side of the uterus. they secrete hormones and produce ova for reproduction. The testes are located one in each side of the scrotal sac, and their functions are to form spermatozoa and to secrete testosterone.

The Pancreas. We have previously discussed the pancreas as an exocrine gland of digestion. However, it contains cells (islets of Langerhans) that secrete insulin into the blood stream. Insulin is essential for the use and storage of carbohydrates of tye body. A sugar imbalance occurs in the body if these cells stop functioning or are destroyed. This condition is called diabetes mellitus.

Exercises (221):

1. Where is the hormone secreted that influences relaxation of the coronary arteries?

2. Name the gland that regulates the body's metabolic rate.

3. What is the function of the parathyroids?

4. What causes diabetes mellitus?

5. Which glands secret testosterone?

1-11. Anatomy and Physiology of the Reproductive System

This chapter has discussed the anatomical structures of various systems and the functions of those structures. But the human body eventually grows old and dies. Individuals who die are replaced by new life, and that subject brings us to the purpose of this section. It lists first the reproductive structures of both male and female and further explains the reproductive process.

222. Specify the anatomical structures of the male reproductive system and their locations.

Male Reproductive Structures. The male reproductive system consists of the penis, testes, and associated ducts and glands shown in figure 1-25.

The penis. The penis is composed of three cylindrical bodies of spongy, cavernous tissue, bound together by connective tissue and loosely covered with a layer of skin. The urethra passes through the penis from the urinary bladder.

The testes. The testes are two oval-shaped structures that descend to the scrotum after birth. The testes originally are located in the inguinal canal prior to birth.

The scrotum. The scrotum is a cutaneous pouch that contains the testes and parts of the spermatic cord. It lies beneath and outside the pelvic floor.

The spermatic cords. The two spermatic cords that suspend and supply the testes are formed by the ductus (VAS) deferens, arteries, veins, lymphatics, and nerves, bound together by connective tissue. They extend from the anterior lower abdominal wall, through the inguinal canal, and into the scrotum.

Ductus deferens (VAS deferens). The ductus deferens is a small tube that connects the epididymus and ejaculatory ducts. It ascends with the spermatic cord through the inguinal canal into the pelvic cavity.

Seminal vesicles. The seminal vesicles are two pouches that lie between the bladder and the rectum.

The ejaculatory duct. The ejaculatory duct is formed by the convergence of the ductus deferens and the seminal duct; it leads into the prostatic urethra.

The prostate gland. The prostate surrounds the first portion of the urethra and is composed of muscle and glandular tissue.

The Cowper's glands. The Cowper's glands are two pea-sized bodies, one lying along each side of the urethra; they have excretory ducts leading into the urethra.

Exercises (222):

1. What structures lie in the inguinal canal prior to birth?

2. What pea-sized bodies lie on either side of the urethra?

3. What structure surrounds the proximal end of the urethra?

4. What structures are formed by the convergence of the vas deferens and the seminal duct?

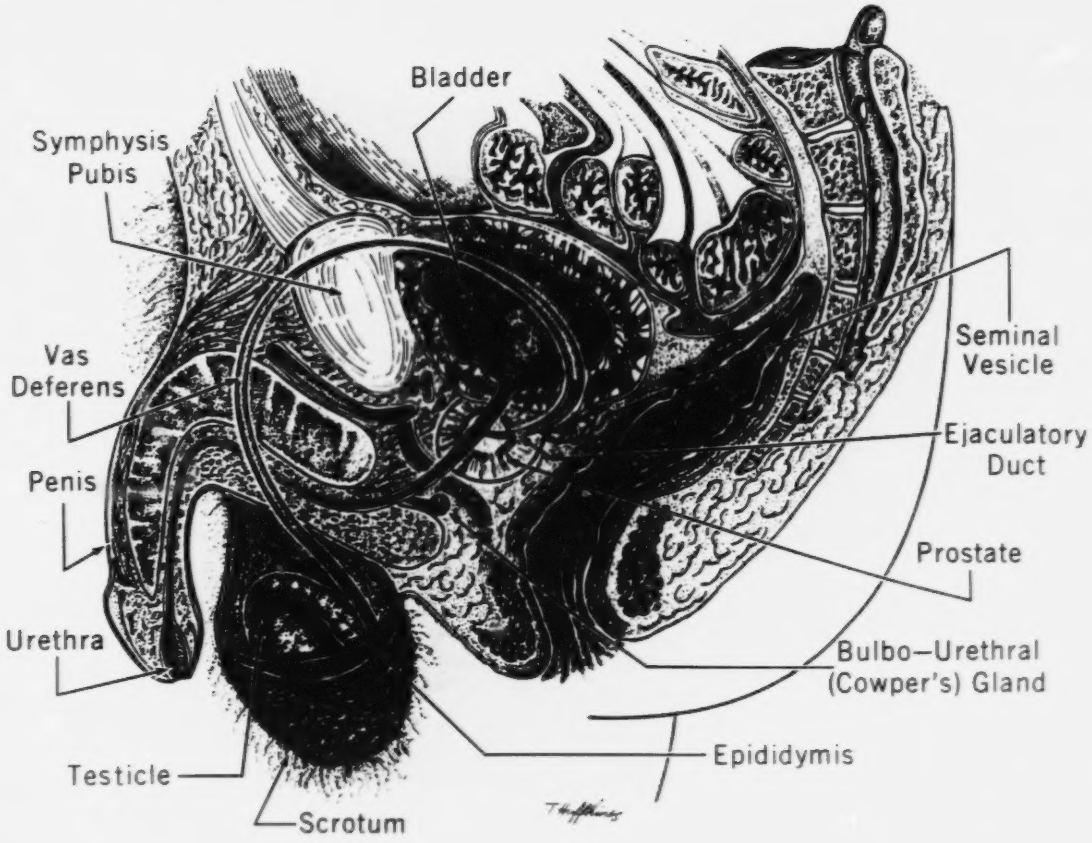


Figure 1–25. The male reproductive system.

5. What structures suspend the testes in the scrotum?

6. What structures are located between the bladder and rectum?

223. Cite each female reproductive structure.

Female Reproductive Structures. The female reproductive system includes the ovaries, fallopian tubes, uterus, vagina, external genitalia, and mammary glands, as shown in figure 1-26.

The ovaries. The ovaries are two almond-shaped glands suspended by ligaments in the upper pelvic cavity, one on either side of the uterus.

The fallopian tubes. The fallopian tubes are two tubular structures that extend from the ovaries and terminate in the uterus.

The uterus. The uterus is a hollow, pear-shaped organ with thick, muscular walls. It is lined with an epithelial tissue called endometrium. The uterus is about 2 ¾ inches long and 2 inches wide at the large end. It has three openings: into the uterine tube on either side above, and into the cervix below.

The vagina. The vagina is a muscular canal lined with a mucous membrane. It extends from the cervix to the vulva (about 3 inches).

The vestibular glands (Bartholins). The vestibular glands are located on either side of the vagina. They have openings that emerge between the hymen and labia minora.

The external genitalia. The external genitalia, referred to collectivuly as the velva, include the mons pubis, labia majora, labia minora, clitoris, vestibule, lesser vestibular glands, and hymen. The mons pubis is the fat pad located anterior to the symphysis pubis. It is composed of a collection of fatty tissue beneath the skin. The labia majora are two folds of skin extending from the mons pubis to the posterior area of the perineum. Within these two folds of skin are two smaller folds called the labia minora. The clitoris is a small body of erectile tissue located at the point where the two labia minor meet; the vestibule is in the area between the labia minora, into which the urethral and vaginal orifices open. The lesser vestibular glands are small mucous glands with ducts opening between the urethral and

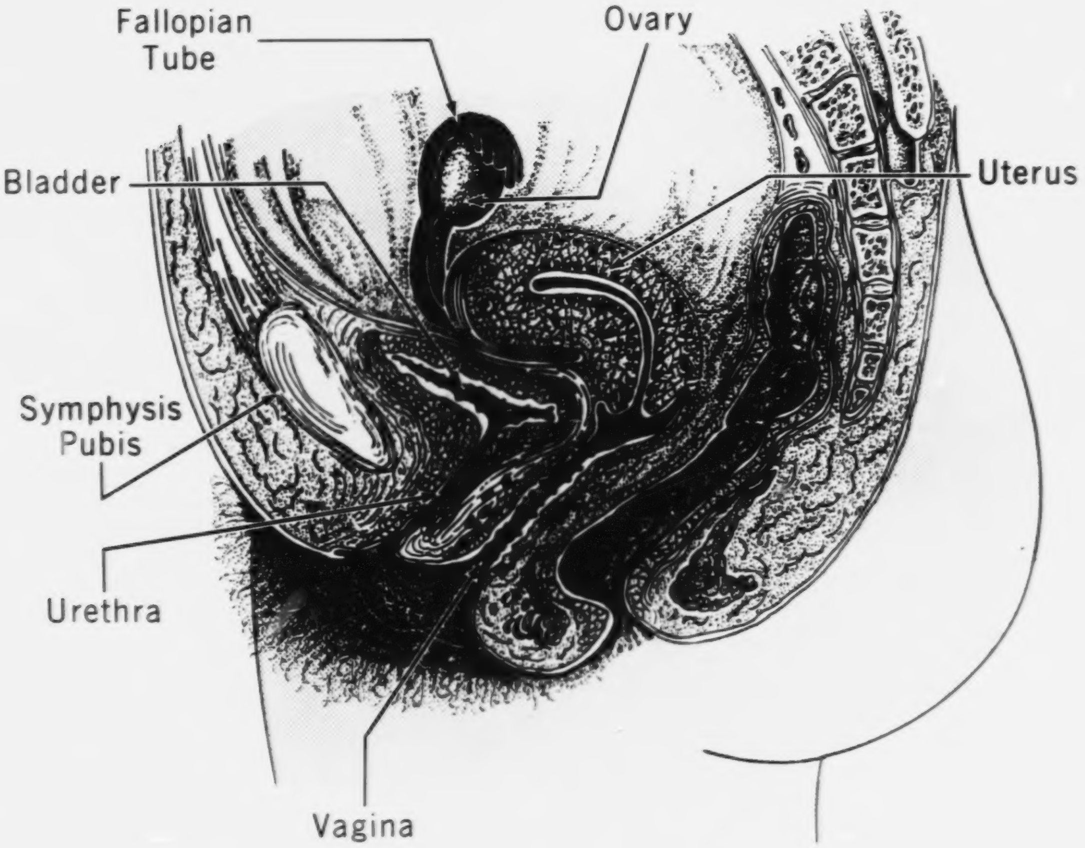


Figure 1–26. The female reproductive system.

vaginal orifices. The hymen is a fold of mucous membrane that extends across the lower part of the vagina.

The mammary glands. The mammary glands, or breasts, are accessory organs of the female reproductive system.

Exercises (223):

1. Match each female reproductive structure in column B with the appropriate definition in column A.

Column A

___ (1) Muscular lined canal extending from the cervix to the vulva.
___ (2) Accessory female reproductive organs.
___ (3) Epithelial tissue that line the uterus.
___ (4) Two almond-shaped glands suspended in the upper pelvic cavity.
___ (5) The neck of the uterus.
___ (6) They have openings that emerge between the hymen and labia minora.
___ (7) The external genitalia.
___ (8) Fold of mucous membrane across the lower part of the vagina.
___ (9) Structures extending from the ovaries to the uterus.
___ (10) Hollow, pear-shaped organ.

Column B

a. Ovaries.
b. Fallopian tubes.
c. Uterus.
d. Vagina.
e. Bartholins glands.
f. Vulva.
g. Hymen.
h. Mammary glands.
i. Endometrium.
j. Cervix.

224. Evaluate the reproduction process by citing the functions of the structures that are involved.

The Reproductive Process. The reproductive unit of the male is the spermatozoa or sperm cell. The testes of the mature male produce sperm. It travels to the ejaculatory duct by way of the vas deferens. Between the testes and the ejaculatory duct, the sperm is influenced by other structures.

a. The sperm cells, which number in the millions, will be mixed with the secretion of the seminal vesicles (semen).

b. The prostate secretes an alkaline fluid to keep the sperm cell mobile and protect them from the acid secretion of the female vagina. It is discharged during the sexual act.

c. The sexual act is aided by a mucous secretion of the Cowper's glands.

The cavernous tissue of the male penis becomes greatly distended with blood during sexual excitement, causing it to erect. It is at this time that the sexual act occurs, thereby projecting semen—bearing sperm into the female vagina.

Concurrently, the female ovaries have produced the ova or egg. Certain sperm of the male will traverse the fallopian tubes and penetrate the egg of the female. The ova is then caught by the fimbriae (projections) of the fallopian tubes and conveyed to the uterus. If fertilization has taken place, the ova is implanted in the endometrium, where it will develop into the fetus. If the egg does not become fertile and further develop, it will detact from the endometrium and be expelled during the menstrual cycle. The fertilization process takes place only during certain monthly cycles that will vary with each female.

Exercises (224):

1. What do the Cowper's glands produce?

2. What protects sperm from acids in the vagina?

3. What structure conveys the fertilized egg to the uterus?

4. Through what structure does sperm leave the testes?

5. What occurs if the female egg does not become fertile and fails to attach to the endometrium?

1-12. Fundamentals of Chemistry

Almost every chemistry book presents a slightly different definition of the science of chemistry. However, if you take all these definitions and condense them, it would read something like this: "Chemistry is the science that deals with the composition of matter and the changes in composition which this matter may undergo".

225. Define matter and cite its properties.

Basic Properties of Matter. Read the definition of chemistry again. It refers to the composition of matter and the changes matter undergoes. But what is matter? Can you see matter, or is it, like so many things in chemistry, something you read about but never see? Look around you. The books on your desk, the desk itself, the walls, and you, yourself, are all matter.

Simply defined, matter is anything that occupies space and has weight or mass. All of the items mentioned in the preceding paragraph are, of course, examples of matter. Since matter must occupy space, it is apparent that two bodies of matter cannot occupy the same space. The possession of mass endows each body of matter with gravitational attraction and thereby gives it weight. The books, desk, and walls we mentioned previously are obviously matter, but what about air and other gases? It is true that a colorless and odorless gas, such as air, is not readily apparent to our senses. Nevertheless, such gases occupy space and have weight, and are therefore matter. Don't jump to conclusions and think everything is matter. Many things of which you are aware are not matter. For example, electricity, rays of light, and sound are *not* matter; but they do exist. Such things are examples of energy, which is defined as the capacity for doing work. We know now that matter can be converted into energy and energy converted into matter under certain controlled conditions.

Matter can be transformed from one form to another. An iron post, if left exposed to moist air, will soon exhibit signs of rust; fruit juices exposed to air will ferment and alcohol will form in them; when wood or paper is burned, the original material, seems to disappear. Under normal circumstances, matter can neither be created nor destroyed; it is merely passed from one form to another. For example, the iron from the post was not lost; it actually entered into combination with the water vapor and oxygen in the air to form a new substance called rust (iron oxide). The alcohol in the fruit juice did not develop from nothing; it was formed from the sugar that in turn disappeared as the alcohol was formed. Likewise, the burned wood produced ashes and gave off gases whose combined weights equal the weight of the original substance.

Exercises (225):

1. Anything that occupies space and has weight or mass is ___________ .

2. The possession of ___________ endows each body of matter with gravitational attraction and thereby gives it ___________ .

3. Matter can be converted into _______ under certain controlled conditions.

4. Matter can be transformed from one form to another, but under normal circumstances, matter can neither be _____________ nor _____________ , since it is merely passed from one form to another.

226. Cite the three physical states of matter, and specify how temperature, pressure, and volume are interrelated.

Physical States of Matter. All matter exists in one of the physical states of solids, liquids, or gases. To understand why matter exists in a particular physical state, you must first realize that all matter is composed of very tiny particles (atoms or molecules). The degree to which the particles are packed together and therefore are more or less free to move about determines whether the matter takes the form of a gas, a liquid, or a solid (see fig. 1-27).

Gases. Oxygen and hydrogen are common examples of gases. Air is a combination of several gases. The particles are far apart in gases. As a result, there are vacant spaces between the particles, and the particles are therefore able to move about in almost complete independence of each other. Since the particles are free to move about, gases do not have shape or boundaries. The volume of a gas can be greatly changed as a result of a change in temperature or pressure, since the particles can be easily pushed farther apart or closer together.

Liquids. Alcohol and water are common examples of liquids. Although liquids have a definite volume at a given temperature, they do not have a fixed shape. Their particles are packed closer together than those of gases; however, they are still somewhat free to move about. As a result, liquids take the shape of the container in which they are placed.

Solids. Wood, glass, salt, sand, and iron are all common examples of solids. In the solid state of matter, the particles are closely packed together and they remain in fixed positions. Solids have specific shapes and boundaries. They may expand or contract slightly upon normal heating or cooling, but they remain hard and in a fixed shape.

Many substances can pass from one physical state to another without changing their chemical nature if temperature and pressure are altered sufficiently. We classify a substance as a gas, liquid, or solid in accordance with the form in which we normally find it under ordinary conditions. For example, we classify water as a liquid—although at a lowered temperature, it becomes a solid (ice) and at an elevated temperature a gas (steam). Thus, matter not only occupies space and has mass or weight but also occurs in various physical states such as solids, liquids, and gases. In this paragraph we have used a substance (water) as an example of a form of matter.

Exercises (226):

1. What are the three physical states of matter?

2. How can the volume of gas be changed?

3. How are the volume and shape of liquids determined?

4. How are solids affected by temperature changes?

227. Differentiate between the physical and chemical characteristics of matter.

Identity of Matter. Any specific form of matter in which all specimens have the same properties will have a specific identity, such as salt, water, and wood. These properties are the physical and chemical characteristics that distinguish one substance from another. When a substance possesses a characteristic, such as odor, color, shape, freezing point, boiling point, or solubility, we call it a the *physical characteristic* of the substance. For example, since water freezes at 0° centigrade and boils at 100° centigrade, we say that these are physical characteristics of water. Sulfurated potash has a distinct odor, color, shape, and solubility; therefore, we list these as physical characteristics.

Chemical characteristics, however, are more difficult to see than are the physical characteristics of a substance. Characteristics such as energy content, reaction with other substances, and reactions with light, heat, and electricity are *chemical characteristics*. For example, salt remains unchanged when heated; whereas sugar will char and burn. Iron will rust if exposed to moist air, while gold does not. If you do not store hydrogen peroxide in a tight, light-resistant container in a cool place, it will chemically decompose. These are chemical characteristics.

Exercises (227):

1. Match the items in column B with the items in column A. Column B items may be used more than once.

Column A

____ (1) Odor.
____ (2) Energy content.
____ (3) Reaction with light.
____ (4) Freezing point.
____ (5) Solubility.
____ (6) Reaction with electricity.
____ (7) Reaction with heat.
____ (8) Boiling heat.
____ (9) Shape.

Column B

a. Chemical characteristics.
b. Physical characteristics.

228. Identify atoms and elements by citing their properties and structures, and indicate how atoms vary not only from one element to another but also within a single element.

Elements. Elements are the simplest forms of matter. They cannot be broken down by ordinary chemical or physical means into simpler substances and cannot be created by the union of simpler substances. At present, scientists know the existence of slightly over 100 elements. Each one possesses its own chemical and physical characteristics. Each of these elements is identified by a chemical symbol. Some common examples of elements and their symbols are arsenic (AS), carbon (C), chlorine (C1),

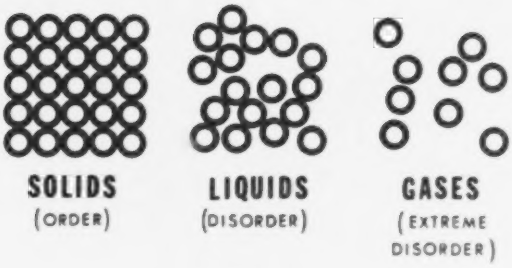


Figure 1-27. States of matter.

Cobalt (Co), copper (Cu), fluorine (F), gold (Au), hydrogen (H), iodine (I), mercury (Hq), oxygen (O), and sodium (Na). A complete listing of all the elements can be found in most dictionaries. These elements, as you will later see, are the building blocks of all matter.

Elements are composed of minute particles called *atoms*. These atoms are the smallest basic particles of an element that still maintain the characteristics of the element. For example, a lump of pure elemental carbon contains only carbon atoms, and pure elemental gold contains only atoms of gold; each atom exhibits the characteristic properties of the element. The atoms in a particular element are different from the atoms found in any other element. In other words, the atoms found in carbon differ from those found in gold and the atoms found in hydrogen differ from both the atoms found in carbon and gold. To understand this difference more thoroughly, you must be more familiar with the structure of the atom.

Although atoms are far too small to see, scientists have determined that they differ widely in size and weight. They range from the hydrogen atom, which is the lightest, to the uranium atom, which is one of the heaviest. Atoms of most metals tend to be heavier than atoms of nonmetals. Although it is impossible to actually weigh an atom, scientists have developed a chart of relative atomic weights. These relative weights are based on the weight relation of a particular atom to an arbitrary atomic weight that has been assigned to the carbon atom. The atomic weight assigned to the carbon atom is 12. The atomic weight of an atom of another element indicates its weight in comparison to carbon. For example, the atomic weight of the aluminum atom is 26.9815. This figure indicates that it weighs slightly more than twice as much as the carbon atom. Another example is the hydrogen atom whose atomic weight is listed as 1.00797; this means that the hydrogen atom only weighs about 1/12 as much as the carbon atom. By knowing the weight of the various atoms, scientists can determine the amount of materials involved in a chemical reaction.

The atoms of the various elements differ in weight because they are structured differently. The simplest atom is that of hydrogen. This atom is illustrated in figure 1-28. One atom of hydrogen is composed of a nucleus (center), which consists of one proton. A single electron orbits the proton in much the same manner as the earth orbits the sun. From this simple drawing of the simple atom, you may have determined that the atom is composed of two particles: the proton and the electron. There is, however, another particle—the neutron. The neutron is found in the atomic structure of all atoms except the simple hydrogen atom. Almost all of an atom's weight is composed of its protons and neutrons. Electrons have practically no weight. The atomic weight of an atom indicates the weight of the atom's protons, neutrons, and electrons in relation to an atom of carbon. In addition to atomic weight, two other figures are used when discussing the atom: the *atomic number* and the mass *number*. The atomic number simply indicates the number of protons in the atom of a particular element. Let's look a little closer at these structures of the atom. Table 1-3 is a chart of the atomic statistics of a few of the elements. Complete charts are available in most dictionaries or chemistry books.

Protons. Protons are located in the nucleus of the atom, and the protons have a positive charge of electricity. The number of protons in the atom of a specific element is always the same. For example, all carbon atoms have 6 protons and all gold atoms have 79 protons. An atom of one element differs from that of another element, depending on the number of protons its nucleus contains. As you recall, the number of protons in the nucleus of a single atom of a specific element is the atomic number of the element. For example, the atomic number of carbon is 6, and the atomic number of gold is 79, because there are 6 protons in the carbon atom and 79 protons in the gold atom.

Electons. Negatively charged particles called electrons surround the atom's nucleus in one or more rings called shells or orbits. The number of electrons in the outer shell can vary from 1 to 8, depending on the element. The electrons are in constant circular motion around the nucleus. The number of electrons in an atom always equals the number of protons. Therefore, since the number of negative charges equals the number of positive charges, the atom as a whole is neutral.

Neutrons. The neutrons, like the protons, are located in the nucleus of the atom. As their name implies, they are electrically neutral. The number of neutrons present in an ordinary atom can be calculated by subtracting the element's atomic number from its mass number. For example, the ordinary carbon element atom has a mass number of 12 and an atomic number of 6; when we subtract 6 from 12, we find that the ordinary carbon atom will have 6 neutrons. In addition to ordinary atoms, most elements also have atoms which are called *isotopes* of the element. These atoms have the same number of protons and electrons as found in all other atoms of the element; however, they have a different number of neutrons. Some of these isotopes

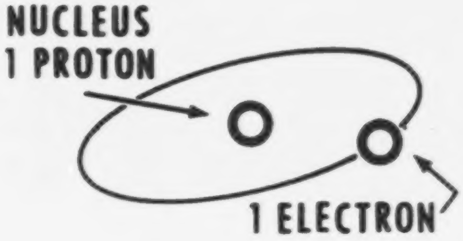


Figure 1-28. An atom.

TABLE 1-3
ATOMIC STATISTICS

ELEMENT NAME	CHEMICAL SYMBOL	ATOMIC NUMBER	MASS NUMBER	ATOMIC WEIGHT
Aluminum	Al	13	14	26.9815
Bromine	Br	35	45	79.909
Chlorine	Cl	17	18	35.453
Fluorine	F	9	10	18.9984
Gold	Au	79	118	196.967
Hydrogen	H	1	1	1.00797
Lead	Pb	82	125	207.19
Nitrogen	N	7	7	14.0067
Sodium	Na	11	12	22.9898
Uranium	U	92	146	238.03

are radioactive and emit radiation; most, however, are not radioactive.

Figure 1-29 shows an *ordinary* sodium atom. Notice that its nucleus has 11 protons and that there are 11 electrons orbiting the nucleus. Notice also that this particular sodium atom has 12 neutrons. We have determined that this is an ordinary sodium element atom, since we know that the mass number of the sodium atom is 23 and there are 11 protons in all sodium atoms. By subtracting 11 from 23, we have calculated that the ordinary sodium atom contains 12 neutrons. An atom that contains 11 protons, 11 electrons, and other than 12 neutrons would be an isotope of the sodium element.

Exercises (228):

1. _____________ are the simplest forms of matter and cannot be broken down by ordinary _____________ or __________ means into simpler substances and cannot be created by the union of simpler substances.
2. Elements are composed of minute particles called _________. They are the smallest basic particles of an element that still maintain the _________ of the element.
3. Atoms differ widely in size and weight ranging from the ___________ atom, which is the lightest to the __________ atom, which is one of the heaviest.
4. The atoms of the various elements differ in weight because they are _____________ differently.
5. The hydrogen atom is composed of two particles: the ___________ and the ___________ .
6. ___________ are located in the nucleus of the atom and have a ___________ charge of electricity.

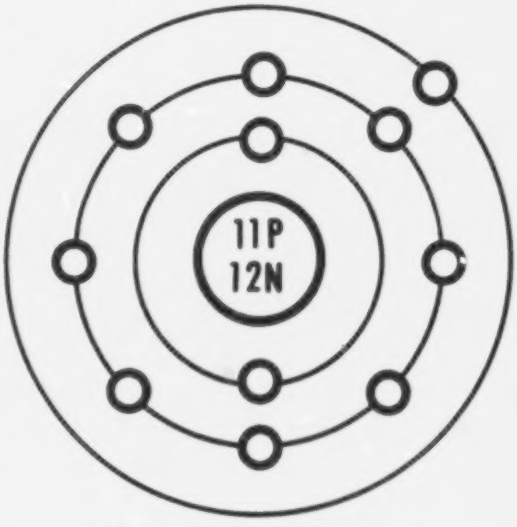


Figure 1-29. An ordinary sodium atom.

7. Negatively charged particles called __________ surround the atom's nucleus in one or more rings called shells or orbits.
8. The number of electrons in an atom always equal the number of ______________ .
9. ______________ are located in the nucleus of the atom and are electrically neutral.
10. In addition to ordinary atoms, most elements also have atoms which are called ___________ of the element. These atoms have the same number of __________ and _________ as found in all other atoms of the element; however, they have a different number of __________ .

229. Define compounds, and name the smallest particle of the compound which maintains the characteristics of the compound.

Compounds. Compounds are substances of fixed composition that result from the chemical union of two or more elements. An example of a compound is ordinary water (H_2O). Water is composed of the elements hydrogen (H) and oxygen (O). When two atoms of hydrogen unite with one atom of oxygen, ordinary water is the result. The composition of water is fixed. By "fixed" we mean that ordinary water is always composed of two parts of the element hydrogen and one part of the element oxygen. The smallest particle of the compound that maintains the characteristics of the compound is the *molecule*. Molecules of some compounds contain a great many atoms; others contain only two or three. Each molecule in the compound is exactly alike. In the case of water, each water molecule always contains two hydrogen atoms and one oxygen atom. If the proportions were different, you would have a different compound. For instance, if you combined two atoms of hydrogen with two atoms of oxygen, you would have a hydrogen peroxide molecule (H_2O_2), and not water (H_2O). If the water is chemically separated into hydrogen and oxygen, it will no longer exist as water but as the individual elements (hydrogen and oxygen).

Exercises (229):

1. Define compounds.

2. What is the smallest particle of a compound which still maintains the characteristics of the compound?

230. Name the property of an atom that determines its chemical activity, and indicate the four types of chemical actions by citing definitions, terms, and manner of occurrence.

Types of Chemical Change. As we have previously stated, the molecules of a compound are created when the atoms of two or more elements chemically combine. The chemical combination occurs because, under certain conditions, the atoms that compose the individual elements will react with each other through the activity of their outer shell electrons. The chemical activity of an atom depends on the number of electrons it needs to borrow, lend, or share to complete its outer orbit. The number of electrons in the outer orbit varies from one to eight, depending on the element. The fewer the electrons an atom needs to complete its outer orbit, the more chemically active the atom. For example, the chlorine atom, which is illustrated in figure 1-30, has seven electrons in its outer shell or orbit. It requires only one electron to complete its orbit. This causes the chlorine atom to be very active.

Basically, there are four types of chemical actions that could occur to create the various compounds. These chemical actions are combination, decomposition, single replacement (or substitution), and double replacement.

Combination. Combination is the simplest method by which compounds are formed. It is the direct union of two or more elements to form a more complex substance. Figure 1-31 illustrates this chemical action. In this illustration, sodium (Na), which has one electron in its outer orbit, reacts with chlorine (Cl), which has seven, to form the compound (NaCl). The horizontal arrow in the chemical equation indicates chemical action. Each such combination of atoms is, as you will recall, a molecule.

Decomposition. Decomposition is the breaking up of a more complex substance. Figure 1-32 illustrates the decomposition of sodium chloride which results in the formation a chloride ion ($Cl-$) and a sodium ion ($Na+$). Ions differ from atoms in that they are electrically charged particles (either positive (+) or negative (−)), and usually have a complete outer orbit. Atoms, as you should recall, are electrically neutral and usually have an incomplete

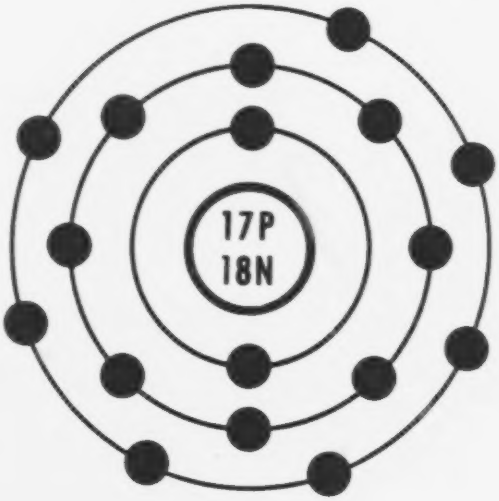


Figure 1-30. A chlorine atom.

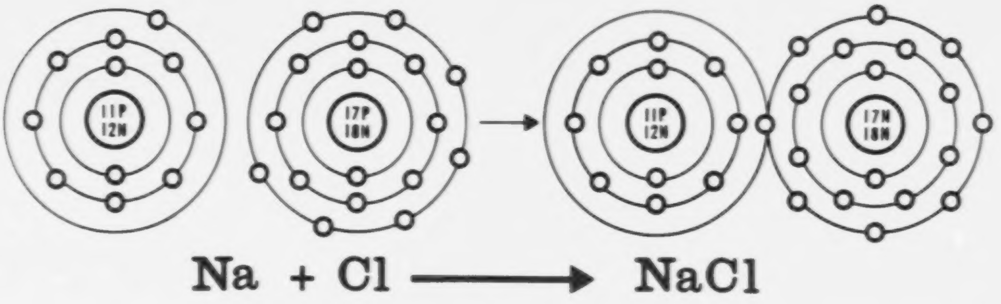


Figure 1–31. Combination.

outer ring. In figure 1-32, the sodium chloride is decomposed through the process of *electrolysis*. Refer to figure 1-33 as we describe this process. The sodium chloride compound is placed in water, and an electric current is passed through the solution. This solution is called an *ionized solution*. When the electric current is passed through the solution, the chlorine and the sodium separate. The chlorine holds onto the extra electron it obtained when it was previously combined with the sodium and becomes a negative ion (Cl−). The sodium, having lost an electron, now has an excess positive charge and is called a *sodium ion* (Na+). As the current passes through the solution, the negative ions (Cl−) are attracted to the positive pole, and the positive ions (Na+) move toward the negative pole. Any compound that undergoes ionization in this manner is called an *electrolyte*, since the resulting compound conducts electricity. The more readily a compound because ionized, the more likely it is to enter into chemical reactions with other compounds. Atoms that resist separation are called *radicals*. Some examples of radicals are OH− (hydroxyl) and NH_4 + (ammonium).

Single replacement or substitution. This is the replacement of one element, ion, or radical by another in a compound. This chemical action may occur either as a result of natural combination, by electrolysis, or by other chemical means. A common example of a single replacement reaction is the moisture contamination of amalgam which readily combines with water to form hydrogen gas, causing the restoration to expand excessively. The equation of this reaction is as follows:

$$Zn + H_2O\ ^{-}\ ZnO + H_2$$

The zinc (Zn) replaces the hydrogen (H_2), and the hydrogen is then given off as a gas, indicated by the horizontal arrow.

Double replacement. Double replacement is the exchange of atoms or radicals between different substances—in other words, an exchange of chemical partners. As with the single replacement reaction, this may occur as the result of a natural combination, electrolysis, or by other chemical means. This double replacement reaction occurs frequently between inorganic compounds, as illustrated in the equation below.

NaCl +	$AqNO_3$	ˉ $NaNO_3$	+ AqCl
(Sodium)	(Silver)	(Sodium)	(Silver)
(Chloride)	(Nitrate)	(Nitrate)	(Chloride)

Exercises (230):

1. Upon what is the chemical activity of an atom dependent?

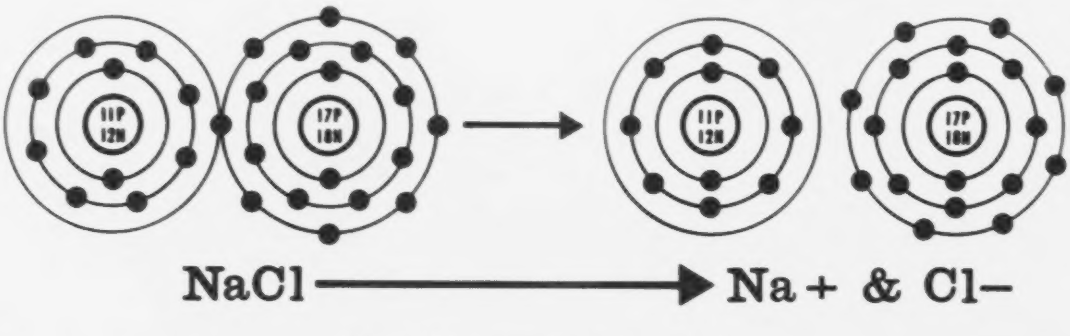


Figure 1–32. Decomposition of sodium chloride.

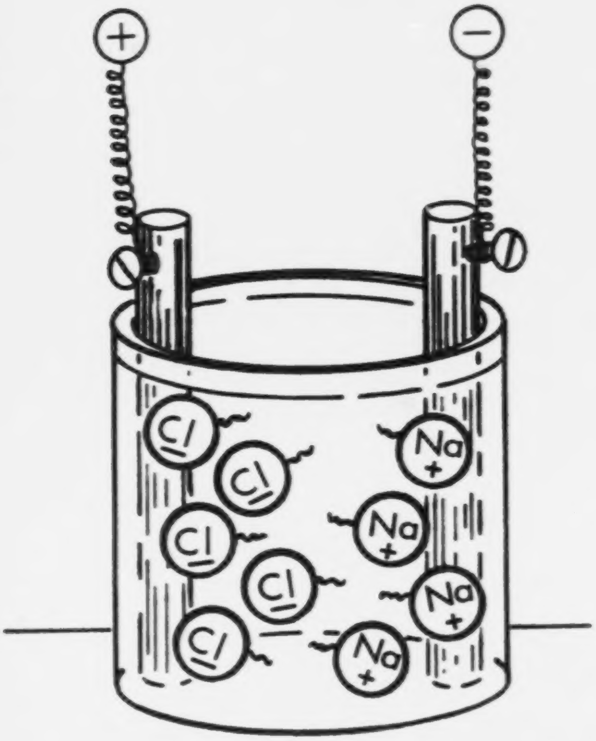


Figure 1–33. The process of electrolysis.

2. What type of chemical action is the simplest method in which compounds are formed?

3. Define decomposition.

4. What term is used for a grouping of atoms that resist separation and always remain together?

5. How does single replacement or substitution occur?

6. What is double replacement?

231. Define the terms "acid," "base," and "salt," and identify how they are classified, their differences, and their properties; and define chemical reactions possible between acids and bases.

Acids. Acids are *classically* defined as substances containing hydrogen that donate hydrogen ions in solution. In solution, acids form no positive ions other that the hydrogen ions. Therefore, they are classified as *protonic;* that is, they release or donate protons. Acids are usually classified according to the number of protons furnished by each molecule.

Monobasic acids donate one proton (HCl).
Dibasic acids donate two protons (H_2SO_4).
Tribasic acids donate three protons (H_3PC_4/.

Acids have the following common properties: They usually have a sour taste, affect some indicators, neutralize bases to form salts, react with some metals to form salts, react with some metallic oxides to form salts, react with carbonates to form carbon dioxide and water, and are usually (but not always) soluble in water. Generally, acids may be prepared by the following methods:

(1) Reacting water with a nonmetallic oxide:

$$CO_2+H_2O^{-} H_2CO_3$$

(2) Reacting sulfuric acid with the salt of the acid:

$$H_2SO_4+NaCl^{-} NaHSO_4+HCl$$

(3) Direct combination:

$$H_2+Cl_2{}^{-}{}_2HCl$$

Bases. A base differs from an acid in that it is a proton acceptor and, when it is dissolved in water, it forms no negative ions other than OH ions. Generally, the proton, a base acceptor comes from the disassociation of water. Bases are usually classified according to the number of protons they accept.

Monoacidic bases take up one proton (NaOH).
Diacidic bases take up two protons ($Ca(OH)_2$).
Triacidic bases take up three protons ($Fe(OH)_3$).

Bases have the following common properties: they have a bitter taste in solution, feel slick and slippery like soap, affect some indicators, react with acids to produce salts, and react with nonmetallic oxides to form salts. Generally, bases may be prepared by the following methods:

(1) Some active metals react with water to form bases:

$$2Na+2HOH^{-} 2NaOH=H2$$

(2) Some metallic oxides react with water to from bases:

$$CaO+HOH^{-} (OH)_2$$

(3) When the salts of calcium, magnesium,and iron come in contact with the soluble bases, double displacement reactions occur, forming insoluble bases which precipitate:

$$FeCl_3+3NaOH^{-}Fe(OH)_3+3NaCl$$

(4) Some substances do not have an OH group but act as bases. For example, ammonia reacts with water as follows:

$NH_3+H_2O^{-}NH_4+(OH)$

Ammonia is considered a base because it furnishes hydroxyl ions. Actually, once the ammonia has reacted with water, it is no longer ammonia.

Salts. A salt is an ionic compound formed by the replacement of part or all of the acid hydrogen of an acid by a metal or a radical acting like a metal. It is an ionic compound that contains a positive ion other than hydrogen and a negative ion other than hydroxyl^{-}. There are four types of reactions possible between acids and bases; these are as follows:

(1) Strong acid and strong base.

$HCl+HaOH^{-}NaCl=H_2O$

(2) Weak acid and weak base.

$2H_2CO_3+Fe(OH)_2{}^{-}Fe(HCO_3)\,2+2H_2O$

(3) Strong acid and weak base.

$2HCl+Fe(OH)_2{}^{-}FeCl_2+2H_2O$

(4) Weak acid and strong base.

$H_2CO_3+NaOH^{-}NaHCO_3+H_2O$

These four reactions result in three types of salts. Reactions (1) and (2) result in neutral salts (a solution of the salt in water will be a neutral solution). Reactions like (3) result in acidic salts, which produce acidic solutions. Reaction (4) results in basic salts, which produce basic solutions. The type of salt is very important when a salt is used medicinally, as the body maintains a specific (PH) in its tissues and fluids.

Exercises (231):

1. Define the terms "acids," "bases," and "salts."

2. How are acids and bases classified?

3. Identify five properties of acids and five of bases.

4. Identify the four possible reactions between acids and bases, and give the results.

232. Define terms related to pH and ionization.

pH. The term "pH" is taken from an expression which literally means "presence of hydrogen." This phrase, in effect, is a definition of pH, for it is an indication of the hydrogen ion concentration of a solution. As a means of relating changes in hydrogen concentrations in small, meaningful numbers, the Danish scientist, Sorensen, devised the pH scale in use today. This scale runs from 0 to 14. While you will not need to calculate a pH value, you may need to interpret what a pH value means. To be better prepared for this function, examine the following pH scale:

14
13
12
11 Increasingly alkaline (basic)
10
9
8
7 Neutral
6
5
4
3 Increasingly acidic
2
1
0

pH scale. As you can see in this scale, readings above 7 are increasingly alkaline. Readings down the pH scale from 7 to 0 are increasingly acidic. For example, a reading of 5.5 would indicate that the solution was acidic. A reading of 8.5 would indicate a alkaline solution. Tooth enamel can start to demineralize at an acidic level of 5.5. The usual method for determining pH is by the use of organic indicators. These are compounds or agents capable of changing color when they are exposed to different pH values. Litmus paper used to test the acidic content of saliva is one example.

Buffers. In order to achieve the proper pH and maintain it, we use compounds called buffers. A buffer is a solution which does not change pH upon the addition of significant quantities of hydrogen or hydro-ions. Buffers resist a change in pH. A buffer is a solution of weak acid and the salt of that weak acid. A buffer is most efficient when the concentration of the acid is equal to the concentration of the salt.

An example of a buffer is carbonic acid/sodium bicarbonate. This is the buffer system which is most common in the fluids and tissues of the body, and it is used to keep the pH of the blood and body fluids constant.

Ionization. As you may recall, electrically charged atoms are ions. The process of providing the necessary energy to an atom to cause it to lose or gain electrons is called ionization. If you dissolve a molecule of lithium chloride in water, the lithium separates from the chlorine. The lithium loses an electron and becomes a positively charged lithium ion. The chlorine gains the electron given up by the lithium and now has one more electron than protons. This chlorine ion now has a negative charge. Should you go a step further and evaporate the water, the unlike charges of the atoms attract one another and a neutral molecule of lithium chloride is formed. Ions are denoted by adding a superscript "+" or "−" sign to the symbol. Ions may be either anions (−) or cations (+).

Exercises (232):

1. Define the following terms:
   a. pH.

   b. pH scale.

   c. Buffers.

   d. Ionization.

233. Differentiate between the two types of mixtures and between mixtures and compounds, and name the process in which diffusion takes place through permeable or semipermeable membranes.

Mixtures. A mixture is composed of two or more elements or compounds that have been physically mixed. No chemical reaction takes place between the parts of a typical mixture. Each element or compound keeps its original chemical properties in a mixture. Generally, mixtures can be separated into individual compounds by physical means. A little water added to a salt-sand mixture dissolves the salt. Filtering the mixture removes the sand, and a little heat evaporates the water, leaving the salt. Many compounds, when placed in water or a similar substance, will form a solution or a supsension.

Solution. Some compounds that have a crystal-like structure, such as sugar or salt, will dissolve in water or a similar substance. A mixture of this type is called a solution.

Suspensions. Some compounds, such as finely pulverized sand, do not dissolve when placed in water or a similar substance; when this is the case, the mixture is called suspension.

Both solutions and suspensions are mixtures rather than compounds, because (1) there is no chemical union between the compound and the medium in which it is dissolved or suspended; (2) within certain limits, the proportions in which the components are present may vary; and (3) the particles can be physically separated from the medium.

When two solutions are poured into the same container, they undergo *diffusion;* that is, the fluids and compounds dissolved in them tend to mingle until the mixture is the same throughout. (Gases, but not solids, may also undergo diffusion.) When diffusion takes place through a permeable or semipermeable membrane, the process is called *osmosis*. If the membrane is semipermeable, it may allow only the fluids to pass through it, or only the fluids and the smaller particles in solution. All larger particles are held back—in other words, the membrane acts like a filter. In the human body, some membranes, such as the filtering membranes in the kidneys, allow diffusion of certain dissolved substances in one direction only. In osmosis, just as in simple diffusion, the mixtures tend to equalize. Osmosis is of great importance in the functioning of living organisms.

Exercises (233):

1. What type of mixture is called a solution?

2. What is a suspension?

3. State three reasons solutions and suspensions are mixtures rather than compounds.

4. When diffusion takes place through a permeable or a semipermeable membrane, what is the process called?

234. Indicate the structure of the metric system as applied to volume, weight, and length, and cite the metric units that are used.

The Metric System. The metric system of weights and measures was made the legal standard for Federal hospitals in the United States by law on 28 July 1866, and all other systems are referred to it for official comparison. It is used as the scientific system of measurement the world over. AFM 168-4, *Administration of Medical Activities*, directs that it is the only system to be used in writing prescriptions in the Air Force. Although you do not write prescriptions, you will still have use for the metric system. For example, when you prepare disinfecting solutions, you use metric volume measures. When you prepare fluoride compounds, you use both metric volume and metric weight measures. And you use the metric length measures to determine the depth of periodontal pockets, size of teeth or lesions, etc.

Note the following facts about the metric system.

a. It is used universally.

b. Every weight and measure has a simple relation to the meter.

c. Every unit is multiplied or divided by 10 to reach the next higher or lower unit. As in our system of money, it is a system of decimal progression; for example, 10 mills = 1 cent, 10 cents = 1 dime, 10 dimes = 1 dollar.

d. It is the only system of weights and measures with a common standard where a unit of weight equals a unit of volume. The common standard is water. For example, under standard conditions of temperature and pressure, 10 milliters of H_2O equals 10 grams.

There are three primary units of measure of the metric system you should become familiar with. They are:

- The meter—the primary unit of length.
- The liter—the primary unit of volume.
- The gram—the primary unit of weight or mass.

Each section of the metric system has a definite unit around which the subdivision and multiples are used—the meter for length, the liter for volume, and the gram for weight. Subdivisions and multiples of these principal units are indicated respectively by Latin and Greek prefixes:

a. The subdivision (from Latin):
  1000 = milli
  100 = centi
  10 = deci

b. The multiples (from Greek):
  10 times = deka
  100 times = hecto
  1000 times = kilo

When you have learned the subdivisions and multiples above, the metric system will not be difficult for you to understand or learn. Remember that it works somewhat like our money system.

To abbreviate each subdivision and multiple of a unit, you use the first letter of the prefix and the first letter of the unit. An example of this is millimeter (mm). There is one exception to this rule and that is the gram. The abbreviation for "gram" is always capitalized "GM" to make a definite differentiation from "grain" which is abbreviated "gr."

The basic metric unit of temperature is the degree Celsius (C). In the Celsius scale, water boils at 100° C and freezes at 0° C. In contrast, in the Fahrenheit (F) scale, water boils at 212° F and freezes at 32° F. The Celsius scale is marked off in increments of 1°. Each ° F is 5/9 the size of each ° C.

Tables 1-4, 1-5, and 1-6 contain the lengths, weights, and fluid measures of the metric system that you may encounter in the dental service.

Exercises (234):

1. When you prepare fluoride compounds, you use both metric __________ and metric __________ measures.
2. When you use the metric system, multiply or divide every unit by __________ to reach the next higher or lower unit.
3. The metric system is the only system of weights and measures with a common standard, where a unit of weight equals a unit of __________ . The common standard is __________ .
4. The meter is the primary unit of __________ .
5. The __________ is the primary unit of volume, and the __________ is the primary unit of weight.
6. The Celsius scale is marked off in increments of __________° . Each °__________ is 5/9 the size of each °__________.

TABLE 1–4

METRIC LENGTHS

Lengths		Abbreviations	
10 millimeters	= 1 centimeter	10 mm.	= 1 cm.
10 centimeters	= 1 decimeter	10 cm.	= 1 dm.
10 decimeters	= 1 meter	10 dm.	= 1 M.
10 meters	= 1 dekameter	10 M.	= 1 dkm.
10 dekameters	= 1 hectometer	10 dkm.	= 1 hm.
10 hectometers	= 1 kilometer	10 hm.	= 1 km.

The metric table may also be written:

1 meter = 1000 millimeters
= 100 centimeters
= 10 decimeters
= 0.1 dekameter
= 0.01 hectometer
= 0.001 kilometer

TABLE 1-5
METRIC WEIGHT

Weights		Abbreviations	
10 milligrams	= 1 centigram	10 mg.	= 1 cg.
10 centigrams	= 1 decigram	10 cg.	= 1 dg.
10 decigrams	= 1 gram	10 dg.	= 1 Gm.
10 grams	= 1 dekagram	10 Gm.	= 1 dkg.
10 dekagrams	= 1 hectogram	10 dkg.	= 1 hg.
10 hectograms	= 1 kilogram	10 hg.	= 1 kg.

The metric table of weights may also be written:

1 gram = 1000 milligrams
= 100 centigrams
= 10 decigrams
= 0. 1 dekagram
= 0. 01 hectogram
= 0. 001 kilogram

TABLE 1-6
METRIC FLUID MEASURES

Measures		Abbreviations	
10 milliliters	= 1 centiliter	10 ml.	= 1 cl.
10 centiliters	= 1 deciliter	10 cl.	= 1 dl.
10 deciliters	= 1 liter	10 dl.	= 1 L.
10 liters	= 1 dekaliter	10 L.	= 1 dkl.
10 dekaliters	= 1 hectoliter	10 dkl.	= 1 hl.
10 hectoliters	= 1 kiloliter	10 hl.	= 1 kl.

The metric table of fluid measures may also be written:

1 liter = 1000 milliliters
= 100 centiliters
= 10 deciliters
= 0. 1 dekaliter
= 0. 01 hectoliter
= 0. 001 kiloliter

1-13. Basic Microbiology

Microbiology is the study of living organisms known as *micro-organisms* that are so small they are visible only with the aid of microscopes. Not all microogranisms cause disease in humans, however, some do. Those that do are known as pathogens. It is important that members of the dental health team have a basic understanding of microbiology so that they may intelligently and conscientiously carry out the steps necessary to control contamination and to prevent the spread of disease through the dental clinic.

235. Identify microorganisms by classification, structural makeup, characteristics, behavior, functions, and diseases they are associated with.

There are many ways to classify microorganisms. Our study divides them into six areas: bacteria, spores, viruses, rickettsiae, protozoa, and fungi. This section discusses their main facets and differentiates between each area to give a general overview of each organism.

Bacteria. Bacteria are one-celled micro-organisms. Unlike the typical cell, a bacterial cell does not have an organized nucleus. The nucleus is diffused throughout the cell. Bacterial cells occur in a number of shapes: spherical, called *cocci;* rod-shaped, called bacilli; and cod-shape, called spirochetes or spirilla. The shape of a particular bacteria is one of the criteria used in its identification. Another factor in the identification of bacteria is the way the cells are arranged or grouped together. An arrangement grouped in clusters like grapes is called staphylococci. Some cocci arrange themselves into pairs. Paired organisms are called *diplo*, thus the term "diplococci." Still another group of cocci, the streptococci, form in long chains. The bacilla organisms, or rod-shaped bacteria, may align themselves into chains or pairs, and these may be called streptobacilli or diplobacilli—but these terms are not often used. The spirochetes vary from a loose spiral to a tightly coiled spring. They may be short or very long. The always appear as individual cells and do not form clusters or chains.

The pairing, chaining, or clustering of bacterial cells is a result of the organism's method of reproduction. The cells multiply by a process called binary fission (fission is "to split"; binary means "two"); thus, the splitting of one organism into two organisms just like the parent cell. If fission is complete, the cells may be found individually or in clusters; but if the fission is incomplete, the cells may remain in pairs or in long chains.

The polymorphic bacteria are just what the name implies, many shapes. They appear as modular filaments, short, clumpy rods, or possibly even Y-shaped organisms.

In addition to different shapes and groupings, some bacteria have special stuctures that aid them in motility or survival in nature. All bacteria posses an outer coating known as a capsule. Some may have a capsule so thin that it is undetectable. Others have a very thick, sticky capsule composed of a complex sugar—fatty—protein substance. Research indicates that this capsule aids in the organism's survival against the white blood cells in the body. To enable them to move about, some of the bacilli have special structures called flagella. A flagellum is a hairlike appendage that whips back and forth and either pulls or pushes the organism about. Some cells have only a single flagellum, while others may have several or may even be completely covered with flagella. The sole purpose of the flagella is movement.

Spores. Another special structure that developes in some of the bacteria is the *spore*. Any time certain organisms find themselves in an unfavorable environment, they concentrate their protoplasm into a little round ball and become extremely resistant to the unfavorable condition. When the spore is formed you can clearly see the rigid cell wall containing the little ball. This dormant form enables the organism to survive adverse conditions that normally destroy bacteria. One species, *Bacillus anthracis* (anthrax), has been known to live for as long as 40 years outside the animal body. Some organisms can withstand boiling for as long as 2 hours.

Another factor must be kept in mind. In order for bacteria to cause disease, they must have the proper environment to survive. Bacteria have no mouth; therefore, they absorb food directly through their cell membranes. Their food or nutrients must be part of their environment, and there must be sufficient moisture to sustain life. Temperature is a critical requirement for bacteria growth. Most disease-producing bacteria can survive only at body temperature. Therefore, when this temperature is lowered or elevated, they will cease to grow and may die. Basically, in order to reproduce or grow, a particular bacteria must have the proper temperature, nutritional requirements, and moisture (environment).

As the bacteria grow, they produce waste products and sometimes excrete other substances used in their digestion. These products, called bacterial toxins, may be toxic or poisonous to us. Exotoxins are toxins which diffuse out of the bacterial cell into the surrounding media. Endotoxins do not diffuse out normally but are liberated by autolysis or physical disintegration. In either case, these are the substances that make bacteria harmful. Can you see that bacteria in their simple one-celled form are actually very complex organisms?

Another method of classifying bacteria is on the basis of their reaction to the Gram stain. In this classification, bacteria are divided into two broad groups, the Gram-positive and Gram-negative. We will discuss this staining process later in this section.

Viruses. Viruses are a group of ultramicroscopic, disease-causing agents. In the past few years, vast amounts of knowledge have been attained about them, but they are still a mystery to people outside the field of virology. They are so different from other disease-causing agents that they cannot be compared with any of them. They belong to neither the plant nor animal kingdom, and only a few can be seen without the aid of an electron microscope. They do not fit our present biological definition of "living" organisms. They do not die. They merely inactivate or disassociate themselves. They do not reproduce themselves but cause a living cell to replicate or reproduce them. They do, however, cause a wide variety of diseases in plants and animals. Examples of viruses-caused diseases are smallpox, measles, poliomyelitis, yellow fever, and the common cold.

Rickettsiae Rickettsiae are a group of organisms intermediate in many characteristics between the bacteria and viruses. Rickettsiae will not reproduce outside a host cell. In other words, they require the presence of a living cell for growth. Rickettsiae are primarily parasites of insects and are transmitted to humans by fleas, lice, mites, or ticks. The most common rickettsiae diseases are Rocky Mountain spotted fever and typhus.

Protozoa. Protozoa is the lowest division of the micro-organisms of animal life and is composed of one-celled organisms. There are many species of protozoa, but the majority are harmless to humans. A protozoa differs from the "typical cell" in that it is a true member of the animal kingdom and does not have a cell wall. Its outer covering is the cell membrane, which is flexible like a plastic bag. It does not possess all the other parts of a typical cell, including an organized nucleus and cytoplasm. Some of these one-celled animals have parts not included in the typical cell. Some have flagella or cilia, which are organs of locomotion, and others have a cytostome, which is a kind of primitive mouth. There are four classes of protozoa. Note that the first two are the causes of diseases most familiar to you.

(1) Sarcodina (amoeba), the type that causes amebic dysentery.
(2) Sporozoa, the type that causes malaria.
(3) Mastigophora (flagellates).
(4) Infusoria (ciliates).

Fungi. The fungi are small members of the plant kingdom commonly referred to as yeasts and molds. They have no roots, stems, or leaves, and possess no chlorophyll. Members of the plant kingdom use chlorophyll to convert carbon dioxide, water and sunlight into sugar. Therefore the fungi lacking chlorophyll must depend upon some other source for their livelihood. This other source concerns us; it is the living organism. We usually refer to an infection caused by the fungi as a fungus infection. Most of the pathogenic fungi produce superficial infections and grow on the skin. The ringworm is an example of this type of infection. Other fungi are responsible for more serious infections where the fungus invades the lungs and other tissues of the body.

Fungi do not look at all like typical cells. They are round, oval, or filamentous, and much larger than the bacteria cell. They have a large vacuole (clear space in the cell), taking up a good portion of the cell and usually a few large granules between the vacuole and cell wall. Identification is based almost entirely on the type of colony the fungi produce. Like bacteria, fungi are ever-present in our environment. Some are harmful to us, while others are beneficial. Fungi have many industrial uses. Penicillium and several other fungi are used in the production of antibiotics. The undesirable fungi are pathogenic to plants and animals and are difficult to control. Spores are found on everything. They blow around in the air and can grow on anything that hints at being a nutrient. Because of their prevalance in nature and their association with disease, they are of prime concern to the field of medicine.

Exercises (235):

1. What are the six categories of micro-organisms.

2. What three factors play a role in the identification of bacteria?

3. What names apply to the following shapes of bacteria?

    a. Spherical.

    b. Rod-shaped.

    c. Coil-shaped.

4. What name would apply to coccal bacteria that arrange themselves into pairs?

5. What name would apply to coccal bacteria that arrange themselves into long chains?

6. By what process do cells multiply?

7. What is the outer coating of a bacteria called?

8. What is a flagellum?

9. When certain organisms find themselves in an unfavorable environment, they concentrate their protoplasm into a little round, protective ball. What is an organism in this state called?

10. What do pathogenic bacteria require in order to cause disease?

11. What are viruses?

12. What micro-organisms are associated with diseases such as smallpox, measles, poliomyelitis, yellow fever, and the common cold?

13. By what means are rickettsiae usually transmitted to man?

14. What are the two most common rickettsial diseases?

15. What is the lowest division of the micro-organisms of animal life that is composed of one-celled organisms?

16. Which group of micro-organisms is responsible for malaria and amebic dysentery?

17. Which group of micro-organisms is commonly referred to as yeasts and molds?

18. What types of conditions may be produced by pathogenic fungi?

19. Why must fungi depend on other living organisms for their livelihood?

1-14. Oral Flora

Although humans have been familiar with some of the effects caused by bacteria for sometime, it was in Holland in 1683 that Anton Van Leeuwenhoek (pronounced Loo-vahn-hoke) invented the first scientific microscope. He was an amateur lens grinder, cutting and polishing quartz. He ground some of the pieces of lens in concave form and others in convex. When he looked through some of these lenses, objects looked larger than they really were. One day while looking through one of the magnifying glasses (he actually made a crude microscope) at some saliva from his mouth, Van Leeuwenhoek became the first person to see a micro-organism. He saw bacteria—or oral flora. Since oral flora are minute unicellular (one cell) plantlike organisisms and since they are colorless, you may wonder how Van Leeuwenhoek could have seen them through his crude microscope. Possibly, he was chewing tobacco and the tobacco juice acted as a disclosing agent and stained the flora. At any rate, he was the first to see bacteria—and they were rod shaped. Since the Latin word "bacteria" means rod shape, the scientists simply called these rod-shaped organisms bacteria. Later this word became a general term, taking in all of the different forms.

236. Identify the characteristics of bacteria that are common to the oral cavity.

Oral flora are the micro-organisms found in the mouth. There are over a hundred types of bacteria found in the mouth alone. This discussion includes five of the most common types. Bacteria are micro-organisms and may be called by many names: microbes, micro-organisms, microflora, germs, and possibly, bugs. The term "oral flora" best describes the micro-organisms found in the mouth. Each bacterium (bacteria) is much like a tiny bit of living jelly surrounded by a clear, thin covering called a membrane. Are these bacteria animals or plants? The answer is that some bacteria are branched and sheathed like plants, but some have locomotive (movement) organs like animals. Thus, in the scheme of life they occupy an intermediary position between animals and plants, with the properties of both. Early bacteriologists agreed to classify bacteria as plants.

Bacteria abound everywhere; you name a place—any place—and you can correctly say that bacteria are found there. Bacteria are usually thought of as something that makes us ill. Very often they do; however, many kinds of bacteria are so useful that we could not live without them. As result of scientific experiments, many diseases can be cured by killing harmful bacteria; at the same time, many other types of bacteria are beneficial to humans.

Categories of Bacteria. There are several different ways to categorize bacteria. Some are termed "saprophytes" and derive their nourishment from dead or decaying matter. These organisms live on or in other organisms, deriving their nourishment at the expense of the living host.

Parasitic bacteria that live in or on a host, but do not cause serious damage, are termed "nonpathogens." Those that severely damage their host by destroying the host's tissues or causing serious infections are called pathogens. A pathogen that causes infection so severe that the host is permanently damaged, or that results in death of the host, is called a virulent pathogen. Nonvirulent pathogens damage the host, but damage is usually not permanent and rarely results in death unless other underlying debilitating (weakening) conditions are present.

Bacteria are further categorized into three groups, based upon their need for oxygen. *Anaerobic bacteria grow only in the absence of oxygen and, in the human mouth, are usually deep in the sulcus. Aerobic* bacteria grow only in the presence of oxygen; that is, they must have oxygen to live. *Facultative* bacteria are the micro-organisms that can live under either aerobic or anaerobic conditions. These can be found deep in the sulcus or on the tongue. Each of these types of bacteria is found in infectious areas. Most bacteria cannot live in direct sunshine.

Bacteria are also distinguished as being either Gram-negative or Gram-positive. This refers to the staining method devised in 1894 by Hans C.J. Gram, a Danish physician. When you use a phase microscope, you have no need for Gram stain. You should know in general what Gram stain terminology means, since it is frequently used. Since living bacteria appear clear under a microscope, stain is needed to see bacteria. A smear is prepared, air dried, and then stained with a primary violet stain, followed in order by a mordant (fixing agent), decolorizer, and counterstain. Some bacteria have the property of retaining the violet dye after having been treated with decolorizer and exhibit a pronounced purple or blue throughout the process. These are referred to as Gram-positive. Bacteria that lose their purple or blue color after decolorization are a pinkish red and are called Gram-negative. The staining process kills the bacteria, and they cannot be as effectively used in motivating your patient to keep a clean mouth as live specimens, which perform all sorts of antics under a microscope. For this reason, the phase microscope—which permits viewing of live bacteria—is effectively used in preventive dentistry counseling.

Forms of Bacteria. Bacteria have many different shapes and forms, as shown in figure 1-34. However, oral bacteria (normal flora) are reduced to five forms for discussion here. This discussion is a superficial explanation of bacteria found in the oral cavity—it presents only that information that may be useful to you in motivating your patients toward better oral health.

Cocci. The cocci (kock′-sigh) forms are usually Gram-positive, nonmotile, and facultative. They are spherical or oval-shaped and about 1/1000 mm in diameter. The cocci forms exist singly or in aggregate (in chains or in colonies with clusters of varied shapes). You must be able to recognize the following types of cocci.

a. Streptococci (strep″-to-kok′-i), the most common of all the oral bacteria, is Gram-positive and facultative. Figure 1-34 shows that it grows in chains. It does not usually cause disease unless it settles on abnormal heart valves (causing subacute bacterial endocarditis), in urinary

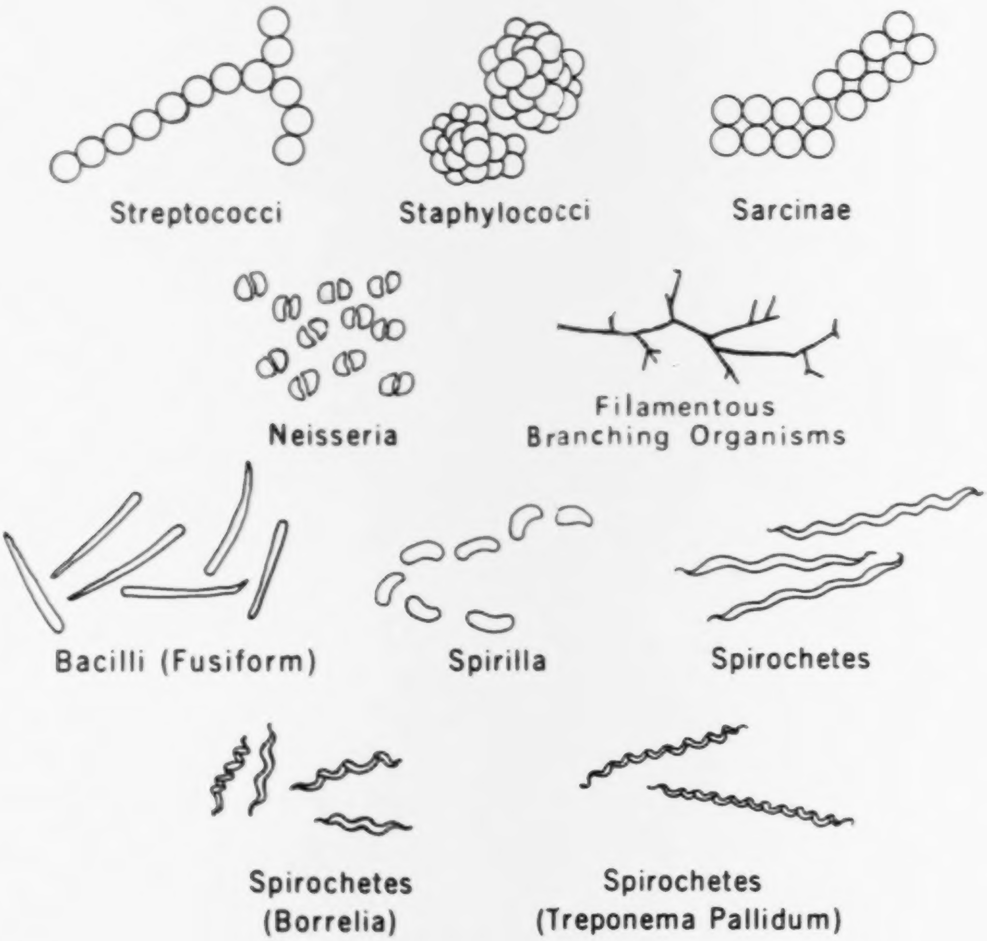


Figure 1-34. Bacterial forms.

tracts, or in the meninges (one of the membranes enveloping the brain and spinal cord). But varieties of streptococci have recently been implicated in the caries process.

b. Staphylococci (staf"-i-lo-kok'-i) are Gram-positive, facultative, and grow in clusters. They are nonmotile and are often found on the epidermal surfaces of human beings. They cause osteomyelitis, boils, abscesses, and ulcers. Some food poisoning is caused by staphylococci. However, they produce various enzymes that are necessary for some normal body functions.

c. Neisseria (ni-se'-re-ah) are Gram-positive cocci, usually occurring in pairs. They occur in the mouth and respiratory tract. They are nonmotile and aerobic and are arranged in pairs with their adjacent walls compressed, as shown in figure 1-34. The Neisseria group includes two parasitic types of bacteria: the gonococci (which cause gonorrhea) and the meningococci (which causes meningitis).

d. Veillonella (va"-yon-el'-ah) are Gram-positive cocci. They are strict anaerobes that physically resemble the Neisseria. It is not clear whether these organisms should be called pathogens. They have been frequently isolated from abscesses on teeth.

Bacilli. Bacilli (bah-sil'-i) are rod-shaped, about 3 or 4 microns long, and 1 micron in diameter. They can be spore-forming, Gram-positive or nonspore-forming, Gram-negative. Some are motile, some nonmotile. They are aerobic, anaerobic, or facultative. There are several types of bacilli, but the types of most importance are fusiform (see fig. 1-34). Fusiforms are Gram-negative, anaerobic bacilli, which inhabit the gingival sulcus and increase to large numbers when NUG (necroizing ulcerative gingivitis) is present. They are susceptible to antibiotics.

Spirilla. The most common spirilla (spi-ril'-ah) oral flora are the vibrios (vib'-re-os). These are short, bent rods (see fig. 1-34). Each has a single polar flagellum (tail). They are either Gram-positive or Gram-negative and are anaerobic. They are found in severe diseases—in deep gingival sulci and in pockets—and are extremely mobile. This little comma-shaped organism will be most helpful to you in motivating your patient toward better oral hygiene, because it will flip across the microscope field of vision like a speedboat, spinning and turning in every direction.

Filamentous branching organisms. These are Gram-positive, anaerobic, nonmotile, branching organisms. They are found around the teeth, in plaque, and in calculus. You probably see two types of filamentous (fil-ah-ment-tus) organisms. An illustration of filamentous branching organisms is shown in figure 1-34.

a. Leptothrix (lep'-to-thriks) are Gram-positive, anaerobic, nonmotile, long-rod forms. The distinguishing feature between the leptothrix and the rod-shaped bacilli is that the leptothrix usually has a long branch extending from the end. Its shape resembles a bent twig.

b. Actinomyces (ak"-ti-no-mi-sez) are Gram-positive, anaerobic, nonmotile, multibranching forms; and they are classified between fungus and bacteria. They most nearly resemble a small branch from a tree that has smaller branches extending from it. Actinomyces israelii (one of three pathogenic species of Actinomyces) is the one found in the human mouth.

Spirochetes. Spriochetes (spi'-ro-kets) are anaerobic organisms which are Gram-negative. Their name, which means coiled hair, is descriptive of their form, as shown in figure 1-34. They are extremely motile and move in a corkscrew fashion. There are two types.

a. Borrelia (bo-re'-le-ah) vincentii are found in necrotizing ulcerative gingivitis (NUG) with the fusiform bacillis. They are comparatively small.

b. Treponema (trep'-o-ne'-mah) are larger spirochetes and are rather rare. They are extremely motile. The invasion by the Treponema pallidum spirochete results in syphilis.

Prevalence of Oral Bacteria. Only once during your lifetime is your mouth without oral flora. The oral cavity of a fetus is sterile—but not for long. Shortly after birth, the oral cavity of a baby shows signs of a developing flora. Soon the bacteria are flourishing. How? Each bacterium increases rapidly by dividing into two bacteria. Under proper conditions, some bacteria divide every 15 minutes. This means that, theoretically, in less then 1 day, one single bacterium can become more than 100 million bacteria! Actually there are 40 million to 5½ billion organisms per cc of saliva—and we have about 10 cc of saliva in our mouths during our waking hours. In addition, there are many, many more organisms in contact with the teeth and soft tissues. The saliva is both an aid and a deterrent to the growth of bacteria. It aids in providing a warm, moist environment; but some secretions in saliva provide a mechanical means of removing bacteria from the mouth, either by expectorating or swallowing.

The bacteria in an infant's mouth before tooth eruption are predominantly aerobic, cocci and short-rod forms. With the eruption of teeth, the bacteria are able to work deep down into the sulcus. During this stage, the oral flora are predominantly anaerobic cocci and short-rod forms. When a person's teeth are lost (becomes edentulous), the deep crevices of the sulcus are lost, and once more the bacteria are predominantly aerobic cocci and rod forms.

Aerobic bacteria are prevalent with good oral hygiene; anaerobic bacteria are prevalent in areas of poor oral hygiene. The greatest number of oral flora are present just before the morning and evening meals. Rapid eating and drinking, expectorating, and using a mouthwash *temporarily* reduce oral flora, but remember how quickly they reproduce!

Exercises (236):

Identify each true statement and explain why the others are false.

____ 1. Early bacteriologists agreed to classify bacteria as animals.

____ 2. Some bacteria are a beneficial to humans.

____ 3. Saprophytes derive their nourishment from dead or decaying matter and, for the most part, do not cause disease.

____ 4. Parasitic bacteria that live in or on a host and severely damage thier host by destroying tissues or causing serious infections are called pathogens.

____ 5. Nonvirulent pathogens usually cause permanent damage to the host and often result in death.

____ 6. Anaerobic bacteria are those that must have oxygen to survive and grow.

____ 7. Facultative bacteria are those that can live under either aerobic or anaerobic conditions.

____ 8. Bacteria that lose their purple or blue color after the discoloration step of the gram-staining process and become a pinkish red are called Gram-positive.

____ 9. Streptococci are the most common of all oral bacteria.

____ 10. Staphylococci have been recently implicated in the caries process.

____ 11. Members of the Neisseria group of bacteria are responsible for gonorrhea and meningitis.

____ 12. Fusiforms are Gram-negative, anaerobic bacilli which inhabit the gingival sulcus and increase to large members when NUG is present.

____ 13. The most common spirilla oral flora are the comma-shaped vibrios.

____ 14. Invasion of the Treponema pallidum spirochete results in syphilis.

____ 15. Bacteria reproduce by laying eggs.

____ 16. Bacteria found in edentulous mouths are predominantly aerobic cocci and rod forms.

1-15. Sterilization

The object of sterilization (all forms of life are completely destroyed) and disinfection (microbial life is destroyed) methods is the total or partial destruction of the many hundreds of micro-organisms that are known to be pathological or to possess the pathological potential to produce disease. Every dental patient may be harboring micro-organisms that are potentially dangerous to themselves and to others. Principles of microbiological control adequately applied in the dental clinic can protect not only the patients but also you and the rest of the dental health also.

237. Identify the procedures involved in the control of microbial activity in the dental clinic.

The base dental surgeon will decide which methods of sterilization and disinfection are to be used in the dental clinic. However, it is the responsibility of the dental assistant to see that the methods chosen are properly used.

The prevention of infectious disease transmission is one of the most important duties of the dental assistant. Unfortunately, this responsibility is often an unsupervised or unchallenged duty. This reflects the degree of confidence placed in you by the dentist and your supervisor. You must conscientiously and faultlessly carry through the procedures each and every time.

It is vital that the dental clinic appear as neat and clean as possible and also that all meterials and instruments utilized during patient contact be prepared and handled so that they do not serve as a route by which a disease may be transferred.

The micro-organisms of which we must be particularly aware are *bacterial spores, serum hepatitis virus,* and *tubercle bacillus*. Adequate clinical control of pathogenic micro-organisms in the dental clinic consists of conscientiously using the appropriate method for each situation, including:

(1) Thorough and appropriate instrument cleaning and sterilization or disinfection after each patient use.

(2) Wiping all objects touched or handled during patient treatment with disinfectant after each patient visit.

Thorough cleaning of the hands with surgical soap and scrubbing and drying with a clean paper towel which is disposed of after a single use. Follow this procedure before starting each patient treatment, or when returning to the chairside area, and after patient treatment is completed.

(4) Proper handling and storage of sterilized instruments.

(5) Using disposable products whenever possible helps to reduce the possibility of contamination and cross-infection. This includes needles, syringes, gloves, and rubber and cotton products.

(6) When indicated, using a disposable face mask and protective eyewear to guard against the hand piece spray and to help prevent the spread of infection by personnel.

(7) Completing all sterilization, disinfection, and cleaning procedures as if you were to be the next patient.

Exercises (237):

1. What is one of the dental assistant's most important yet often unsupervised or unchallenged duties?

2. What three micro-organisms must we be particularly aware of?

3. Why should disposable products be used whenever possible?

238. Define sterilization and identify the procedures, methods, and equipment involved in the sterilization of dental instruments.

The term *sepsis* means the presence of disease-producing micro-organisms. *Asepsis* means being free from pathogenic micro-organisms. Asepsis is essential to minimize the hazards encountered by those exposed to bacteria and viruses. Asepsis cannot be achieved within the oral cavity, where only a partial reduction in bacterial count is possible. Nevertheless, every precaution must be taken to provide all possible protection for the patient and every member on the dental health team. Sterilization and disinfection procedures are carried out to accomplish this.

Dental items that are to be sterilized or disinfected can be placed into one of three classifications. The first classification is for *critical items*, this includes objects that enter the skin or mucous membrane and present the greatest risk of infection. Examples of these objects are—scalpel blades, injection needles, periodontal knives, and suture needles. The second classification is *semicritical items*, this includes objects that frequently contact mucous membranes or broken skin. Examples of these objects are—mouth mirrors, dental handpieces, high-volume evacuation tips, and rubber dam clamps. The third classification is *noncritical items*, this includes objects that don't ordinarily contact mucous membranes or broken skin. Examples of these objects are—lamp handles, X-ray tube heads, and cabinet tops. The term "noncritical" does not imply nonimportance, it refers only to contact with mucous membranes or broken skin.

Once you have determined what classification a dental item should be placed in, you need to then determine to what level the item is to be disinfected. *High level* requires a method that is effective against all classes of microbes. The term high level is synonymous with sterilization. This level of disinfection is used for all critical and some semicritical items, depending on the item. *Intermediate level* will not kill spores but is effective against all other classes of microbes. This level is used for semicritical and noncritical items, depending on the item. Low level is not effective against tubercle bacille, bacterial spores, and certain nonlipid small viruses. This level is used only for noncritical items.

Sterilization. Sterilization is the process by which *all* forms of life are completely destroyed in a circumscribed area. This includes all forms of microbial life such as bacteria, fungi, viruses, and bacterial spores. Sterile is an absolute term! There is no such thing as partially sterile or "almost" sterile. Modern standards call for sterilization of all instruments that will penetrate, or are likely to penetrate, the soft tissue. This includes surgical instruments, needles, injectable drugs, rubber dam clamps, scalers, scalpels, periodontal probes, and matrix retainers. Also, sterilization is strongly recommended for all instruments that may have been contaminated by the hepatitis virus or by a possible carrier.

Hand instrument preparation. Sterilization and disinfection do not begin until the instrument is clean and free of debris. The presence of blood, tissue, oil, or other materials present a barrier to steam, heat, or boiling water and may render chemical agents completely ineffective. Therefore, before instruments are sterilized or disinfected, they must be thoroughly cleaned.

Instruments should be thoroughly scrubbed with a stiff brush, running water, and detergent. Then they should be completely rinsed and drained before proceeding with either sterilization or disinfection. The ultrasonic cleaner may be used instead of hand scrubbing to clean instruments. Its advantage is that it can get into areas that cannot be reached by ordinary scrubbing. Also, it has some disinfecting ability through the mechanical disruption of bacteria. However, it does not replace other sterilization procedures.

You should be very careful when handling contaminated (dirty) instruments. Any wound, particularly a puncture wound, from a contaminated instrument is potentially dangerous and should receive prompt and careful first-aid attention.

Autoclaving. Steam under pressure is one of the most effective and practical methods for sterilization of dental instruments. The efficiency of the autoclave depends on the boiling point of water increasing with pressure. At sea level atmospheric pressure (14.7 psi), water boils at 10°0 C (212° F), which is too low to destroy many types of pathogenic organisms. However, at two atmospheres (twice the atmospheric pressure at sea level), the boiling point increases to 121° C (250° F). This is the temperature inside the autoclave when the gauge reads 15 psi, and at this temperature all known organisms are killed.

It is also important to remember that this is optimal combination of pressure and temperature for sterilization. At 15 psi and 121° C, *saturated steam* is generated. This is water that is just on the boundary between the liquid and the vapor phase. As this saturated steam strikes colder objects, it condenses to water. This condensation is accomplished by a shrinkage of volume and local reduction of pressure which draws in more surrounding steam. As the object is heated, the temperatures are equalized, and condensed water returns to the vapor phase. Figure 1-35 illustrates the principle of operation for steam under pressure sterilizers. If too little water is used, the steam will be superheated but not saturated. In this state, it is too hot to condense upon striking a cooler object and its action is the same as hot air. However, neither the time nor temperature of the autoclave is adequate for dry heat sterilization. Therefore, use sufficient water to produce the saturated steam necessary for autoclaving.

Autoclaving may be used for any objects that are not damaged by moisture or high temperatures. Stainless steel instruments may be autoclaved; those made of carbon steel, however, should *not* be autoclaved, for this will dull their cutting edges. Care must be taken that the autoclave is properly loaded so that the steam may quickly permeate the entire mass.

These autoclaves must be placed on a solid surface, with the electric cord and door away from the traffic area. Each autoclave has a mark inscribed to indicate the correct water level. Distilled water is added to bring the fluid level up to this line before each use of the autoclave. Carefully follow the instructions printed on the equipment data plate when you start the autoclave and later when you open the door after the sterilization cycle is complete.

The interior of the autoclave should be cleaned at weekly intervals. If you have failed to consistently use distilled water in the autoclave, a scale will form on the interior surface. Light scale may be removed with soap and a stiff brush. Removal of heavier scale requires the addition of one-half cup of vinegar to the water in the autoclave reservoir. Operate the unloaded empty autoclave through a regular sterilizing cycle and then remove the vinegar water. Ventilate sufficiently to remove any offensive odor. Rinse and refill to the correct level with distilled water.

Unsaturated chemical vapor. This is the preferred method for sterilizing most dental instruments for two reasons: carbon steel instruments will not corrode (provided instruments are dry when placed in the chamber) and instruments are dry at the end of the cycle. This process

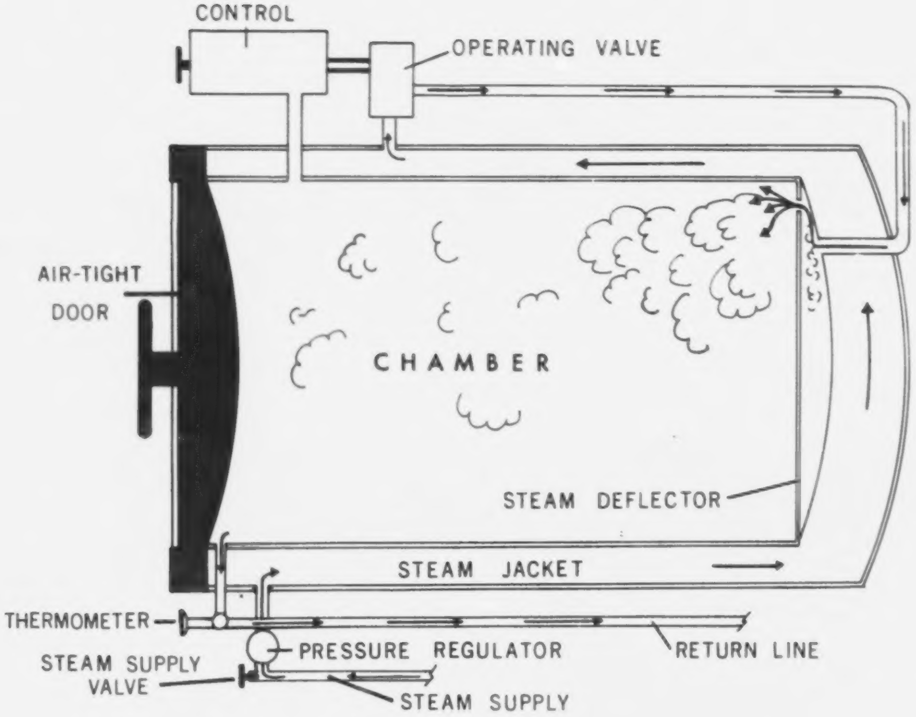


Figure 1-35. Steam under pressure sterilizers.

uses a vapor created by heating a mixture of alcohol, ketone, water, acetone and formaldehyde to effect sterilization. This solution can be used only once; condensed vapors are collected in a container beneath the sterilizer and should be discarded.

Unlike the steam autoclave, the chemical vapor sterilizer must be preheated. Instruments are loaded in much the same manner, but cloth should not be used as a wrapping material. When the chamber door is opened at the end of the cycle, some vapor may escape. For this reason operate the unit in a well-ventilated area, open the door at arm's length, and stand back for 10 seconds before approaching the sterilizer to remove instruments. When not in use, the chamber door should be closed, but not latched, to increase the life of the door gasket.

Autoclave Wrap. Dental instruments are usually packaged individually in sets or in packs before placing into the sterilizer. The most common packaging material are paper bags, plastic/paper bags, nylon tubing, and cloth. Instruments may also be placed in covered trays for storage. The material used depends somewhat on the method of sterilization. Wrap instruments loosely and leave space between packs to allow room for the sterilizing agent to circulate and penetrate to the instruments. Place glass containers on their sides with their lids alongside them. Bags should be tape-sealed; nylon tubing can be taped or heat-sealed.

Autoclave indicator tape is made to change its color when it has been exposed to steam. However, this does not assure that it has met the proper combination of time, temperature, and steam under pressure that is necessary for sterilization.

Dry heat sterilization. Dry heat sterilization is a clinically approved method that, like the chemical vapor sterilizer, will sterilize instruments without causing rust and corrosion. Also, many instruments such as root oftenal boxes, blades, and scissors can can be sterilized more easily by this method. Dry heat routinely should not be used for instruments made of aluminum or delrin. A small electric oven produces temperatures of 160° C (320° F). However, sterilization requires at least 1 hour at this temperature because it is dry heat, not moist heat.

There is little maintenance for these ovens other than normal dusting—and using common sense. (CAUTION: Cotton, paper, plastic, and rubber may melt, scorch, or burn at these temperatures.) Proceed with when you place items in these ovens. Remember, an instrument is hot enough at sterilizing temperatures to give severe burns if touched. The outside of the sterilizer will also be very hot. Allow sufficient time for the instruments to return to room temperature before handling and avoid touching the unit when it is in operation.

Heat Transfer. Many dentists sterilize small instruments, such as root canal instruments, at the dental chair with a small, heat-transfer sterilizer, usually called a bead sterilizer. In the glass bead, or salt, sterilizer either small glass beads 1 to 2 mm in diameter or ordinary table salt is heated in a "well." With the beads or salt, root canal instruments may be sterilized in 15 to 20 seconds, and cotton pellets and absorbent points in 10 seconds at 218° to 246° C (425° to 475° F). Metal instruments require 20 to 30 seconds. Most glass bead sterilizers are equipped with a signal light to indicate when the desired temperature has been achieved and then will thermostatically maintain that temperature. These units get very hot. Be cautious when handling them to prevent injury.

Sterilization Monitoring. Because human error, improper packaging and wrapping, overloading, and sterilizer malfunctions can prevent sterilization, we must have a method to check the sterilizer to make sure it is operating properly. We do this with biological spore tests, chemical indicators, and process indicators.

Biological spore tests (strips, ampules) contain live spores. These strips or ampules are placed inside a centrally located pack to check the operation of the sterilizer. You then send the strip to a laboratory for culturing or place the ampule in a small incubator in the dental clinic. In either case, a negative report for bacterial growth demonstrates that the unit is operating correctly. Spore testing should be done weekly. It is the only way to insure that sterilization has taken place.

Chemical indicators (strips, cards, labels) change colors when exposed to a certain temperature range, but they do not guarantee sterilization. They do, however, provide a quick visual check to verify that the pack has been through a sterilization process and should be placed in every pack (at the present time there are no chemical indicators available for a chemical vapor sterilizer).

Process indicators (tape, bags with heat sensitive printing) are another way to identify instruments that have been processed. Lines on the tape and the printing on the bag will darken after exposure to certain temperature ranges. These can be used in all methods of sterilization except, of course, the heat transfer procedure.

Maintaining Sterility. Sterility of dental materials and instruments is much harder to maintain than it is to achieve. There is little value in a precise sterilization procedure if instruments are contaminated upon completion of that procedure. All items should be removed from the sterilizer with sterile transfer forceps and placed on or in an appropriate storage unit. There is some disagreement as to whether instrument packs should be dated before or after sterilization. Either time is acceptable, provided certain conditions are taken into consideration. If you date a pack prior to sterilization, ensure that it becomes sterilized as soon as possible. A delay in sterilizing the pack means the time for resterilization will be shortened and unnecessary sterilization might shorten the life of the instrument. Also, use a marking device that won't run or fade when exposed to sterilization. Use a pencil, not a grease or ink pen. If you elect to mark the instrument pack after sterilization, the time for resterilization will be more accurate. However, it is difficult to write on a pack that is wet with moisture and full of instruments. Do not tear the pack when you write on it for this will void the sterilization process. Also, remember the instruments are hot at the end of the sterilization cycle. Mark supplies to show the date the sterilized article is no longer considered safe to use and sign your name.

The time span for which an article can be considered sterile depends primarily on its wrapping. Some wrappings provide freedom from contamination for as much as 6 months, while others provide as little as 2 weeks' protection. Check with your dental officer or the hospital central supply service to determine the sterilization expiration dates for your particular type of packs. Place all sterilized packs in their proper locations. They should remain clean, dry, and free from dust. Place like items together and arrange them according to expiration date, placing items with later dates toward the rear. Check supplies periodically to determine any necessity for reautoclaving. Items must be resterilized if the wrapper becomes wet, if the pack touches the floor, if there is any question of contamination, or if the safe storage period has expired.

Exercises (238):

1. Explain the difference between sepsis and asepsis.
2. What must occur to achieve sterilization?
3. Modern standards call for sterilization of what type of instruments?
4. How should you prepare instruments prior to sterilization or disinfection?
5. Upon what does the efficiency of the autoclave depend?
6. Saturated steam is generated at ____ psi and ______° C.
7. Explain what will happen if too little water is used in the autoclave during the sterilization cycle.
8. How often should you remove the autoclave be cleaned and how should light and heavy scale?

9. Why is unsaturated chemical vapor the preferred method for sterilizing most dental instruments?

10. What precautions should be observed when operating a chemical vapor sterilizer?

11. What are some of the most common packaging materials used as autoclave wrap?

12. What is an advantage of dry heat sterilization?

13. What cautions should be observed when operating a dry heat sterilizer?

14. For what purpose is the heat transfer sterilizer used?

15. Name and briefly explain the three methods for monitoring sterilization.

16. When should you date sterile packs?

17. What is the primary concern when determining how long an article can be considered as sterile?

18. What should you do if the wrapper of a sterilized pack becomes wet?

1-16. Disinfection

It is not practical, or in some cases even possible, to sterilize some pieces of dental equipment and operatory environmental surfaces. However, in order to prevent possible cross-infection, these items and surfaces must be thoroughly cleaned and disinfected after each use. With experience you can quickly accomplish this process in a matter of a few minutes. The real challenge comes in the selection of the proper disinfectant solution. Some agents are too expensive or may damage surface materials and/or human tissues. Other agents need extended treatment periods, while others have a limited spectrum of activity. Obviously, there is a need for a safe, quick-acting disinfectant that can be used without overt concern as to cost in the dental operatory.

239. Define disinfection, explain its purpose and methods, and identify the targets of disinfection.

Disinfection. Disinfection is defined as a process, either heat or chemical, by which microbial life is destroyed. However, this does not necessarily include the destruction of resistant bacterial spores. A *disinfectant, bactericide* or *germicide* is an agent, usually chemical, which destroys all vegetative bacteria within 10 minutes. Vegetative bacteria include the tubercle bacillus, animal parasites, fungi, and all viruses except the hepatitis virus. However, disinfection should not be expected to destroy spores.

A *bacteriostatic* agent is one which inhibits microbial reproduction but does not kill the population. The prefix *anti* and the suffix *static* refer to inhibiting properties and do not imply lethal potential. *Bactericide* and *germicide,* both ending with the suffix *cide,* help to decimate to to the microbial population.

Disinfectants are commonly used to treat instruments, equipment and supplies; however, they are not usually used on living tissue. An *antiseptic* is a chemical that is brought into contact with living tissue, the skin or mucous membranes, to inhibit or destroy the micobial population. Antiseptics are, in most instances, less concentrated than are disinfectants. The commonly used methods of disinfection are with boiling water and with chemical disinfectant.

Targets of of disinfection. For the purpose discussing disinfection, micro-organisms can be divided into four general groups, depending on their relative sensitivity or resistance to chemical disinfectants.

Vegetative forms. All micro-organisms exist in the vegetative state at some time in their life cycle, and in this state they are relatively easy to kill. Vegetative forms of bacteria invalidate growth and nutrition rather than reproduction.

Encapsulated or acid-fast. Some organisms, including the tubercle bacullis, are entirely vegetative but have a relatively impermeable waxy coating that gives them greatly increased resistance to many agents.

Spores. Certain bacteria and fungi form spores during their life cycle, and these bacterial spores are the most resistant forms of life known. Fortunately, few pathogens form spores but these that do, such as those that cause tetanus and gas gangrene, are extremely hazardous.

Viruses. Little is known about the resistance of these organisms to chemical agents, the viruses being so much smaller than bacteria and thus more difficult to study. It is known, however, that viruses are similar to bacteria in that they have a wide range of resistances.

Exercises (239):

1. Define disinfection.

2. Explain the difference between a bacterostatic agent and a bactericide.

3. What is an antiseptic?

4. What methods are commonly used for disinfection?

5. Match the micro-organism in column A with its proper description in column B.

Column A

____ (1) Vegetative.
____ (2) Encapsulated.
____ (3) Spores.
____ (4) Viruses.

Column B

a. Little is known about the resistance of these organisms to chemical agents. Similar to bacteria, they have a wide range of resistance.
b. All micro-organisms exist in this state at some time in their life cycle.
c. The most resistant form of life known. Some forms of micro-organism cause tentanus and gas gangrene.
d. Are entirely vegaetative but have a relatively impermeable waxy coating that gives them greatly increased resistance to many agents.

240. Identify factors affecting germicidal activity and list recommended disinfecting agents.

Many factors determine the effectiveness of a germicidal agent. these factors are listed below.

Dilution. Follow the proper dilution, or concentration, of the agent as prescribed in the directions by the manufacturer. Haphazardly estimating the amount of agent and water may cause the solution to be ineffective.

Time of Exposure. Disinfectants do not destroy all micro-organisms on contact. Time of exposure depends upon the materials to be disinfected, the quantity, the number and type of organisms, and the concentration and rapidity of penetration of the germicide. Again, follow the manufacturer's directions.

Temperature. A warm solution is likely to be more effective than a cold one because heat lowers surface tension and increases the speed of chemical reactions in disinfection.

pH. Some disinfectants are more active in acid; others in alkaline environments. Deviation from the desired pH directly alters the effectiveness of the disinfectant.

Objects to be Disinfected. Flat, smooth-surfaced objects are more readily disinfected than are porous, uneven, rough surfaces. Hinged instruments, such as scissors or forceps, and tubing or needles with their lumens are more difficult to disinfect because crevices and small openings permit poor penetration.

Organic Matter. The presence of pus, blood, saliva, or dental materials affects the efficiency of germicides. Some chemicals coagulate and combine with proteins and produce barriers or films about the micro-organisms that inhibit penetration of the disinfectant into the bacterial cells. Also, all the active ingredients of the solution may become involved with the organic coating so that none will be available to kill the micro-organisms.

Types of Micro-organisms. Do not use disinfectants to destroy spore-bearing organisms if heat sterilization is available.

Disinfecting Agents. Disinfectants are used for a number of purposes, including instrument disinfection, skin disinfection, and general surface disinfection, which refers to general housekeeping applications. No single disinfecting solution can be used for all purposes any more than any a single antibiotic can be expected to act against all types of diseases. Carefully study the labels and directions on disinfectants to ensure that the product can do the necessary job.

Because soaps, detergents and fatty materials are not compatible with quaternary ammonium compounds (a derivative of an ammonium ion), it is necessary to scrub and then rinse. Failure to drain instruments throughly before placing them in the solution can result in dilution and a reduction in the effectiveness of the solution

The composition of containers used for chemical agents should not be affected by the agent. Materials such as pyrex, glass, and stainless steel are acceptable for most solutions. No container should be used without a lid or suitable cover to keep out dust and air contaminants. Solutions should be changed frequently to maintain proper concentrations and to reduce the possibilities of cross-contamination.

Many different chemical disinfectants are available, with varying degrees of effectiveness. The ADA Council on Dental Therapeutics recommends only four glutaraldehyde, formaldehyde, chlorine, and iodophore compounds. These and others are discussed next.

Glutaraldehyde. Microbiological testing indicates that a 2-percent percent solution of activated glutaraldehyde (brand name Cidex) is effective in the destruction of fungi, viruses, and bacteria, including mycobacterium tuberculosis. In addition, these solutions are reportedly capable of killing resistant spores.

For *disinfection,* items must be immersed in most solutions for at least 10 minutes. For *sterilization,* a period of 10 hours or overnight is recommended (to prevent corrosion, carbon steel objects should not immersed for more than 24 hours). Forceps should be used to place and remove instruments from the solution. This is because (a) putting your hand in the solution may contaminate it and (b) prolonged exposure to the solution will cause a golden-brown skin discoloration.

Glutaraldehyde is not a substitute for other sterilization procedures, such as autoclaving or dry heat. It is particularly valuable, however, for obtaining a high level of disinfection or sterilization for items that cannot be treated by other procedures. This includes rubber or plastic articles, instruments containing adhesive,bonded parts such as lenses or mirrors, and dental handpieces.

Formaldehyde. This is a flammable, colorless gas with a pungent, suffocating odor. It is volatile and irritating to skin and oral tissues. Its microbal destruction mechanism is the same as that of the glutaraldehydes, but its disadvantages preclude its usefulness as a routine disinfectant.

Iodophors. Iodophors compounds such as Betadine and Wescodyne contain 0.05 to 1 percent iodine and surface-active agents, usually detergents, which carry and release free iodone. The antimicrobial activity of the iodophors is greater than that of iodine alone; and because the vapor pressure of iodine is reduced in the iodophors, its odor is not as offensive. In addition, iodophors do not stain as readily as iodone, especially when the surface treated is wiped, after an appropriate contact time, with a gauze wet with water, 70 percent alcohol, and one percent sodium hypochlorite.

Intermediate levels of disinfection can be achieved after ten to thirty minutes of contact. Some iodophors such as Betadine are also effective when diluted with seventy percent isopropyl alcohol (1 part iodophor to 20 parts alcohol), and some iodophors such as Wescodyne, can be diluted one to two hundred with water; however, the slight straining that occurs with Wescodyne cannot be wiped off as easily.

Alcohol. Sixty to 95 percent concentrations of ethyl or isopropyl alcohol are effective against vegetative bacteria of all kinds. However, absolute alcohol and dilutions weaker than 60 percent are not effective. The water present in the medium (alcohol) promotes killing of bacteria because it is a vehicle for transporting substances through the cell wall and is an aid to the coagulation of microbial protoplasm. Seventy percent isopropyl alcohol is the concentration most commonly used.

Alcohol is not without disadvantages. It is volatile and requires strong concentrations that irritate tissues. Further, it has no sporicidal power. Blood and other high protein organic matter tend to inactivate alcohol, so it is important to clean and wipe instruments thoroughly before they can be disinfected in alcohol. Because blood and other proteins coagulate in alcohol, it should not be used to disinfect objects with small apertures, such as syringe-needle assemblies. Another disadvantage of alcohol is that it mildly attacks rubber and certain plastics.

Iodophor-alcohol. Iodophors are compounds in which surface active agents serve as carriers and solubilizers for iodine. These agents are usually detergents to which iodine (I^2) quickly binds. These complexes serve as reservoirs that release free iodine. An iodophor enchances the antimicrobial activity of the iodine present and reduces the vapor pressure, thus dramatically decreasing the offensive odors. Also, such preparations do not readily stain and are easily mixed in water.

Alcohols have been used since the turn of the century as disinfecting agents. Antimicrobial action involves the denaturation (change) of cellular proteins. A small amount of water must be present for maximal effect, thus 60 to 95 percent is more effective than totally pure forms. Unfortunately, alcohols rapidly evaporate, lack sporicidal activity, and are ineffective against hepatitis B viruses. However, when the iodophor detergent is mixed with an alcohol, the resulting solution is more effective, even against TB and hepatitis viruses.

Sodium hypochlorite. Sodium hypochlorite (household bleach) is one of the most generaly used and convenient forms of chlorine. It is highly efficient as a disinfectant and deodorant. However, unless it is diluted, it irritates the skin and the mucous membrane.

Wiping agents. Glutaraldehyde solution is frequently used as a wiping agent for areas and instruments that cannot be sterilized by other means. Wiping agents are limited in their effectiveness because of the wide variation of surfaces and time of exposure; hence, these preparations and their areas of use are among the weakest links in dental asepsis. Give special attention to this portion of the clean-up phase.

The "wipe-down" procedure must be a standard part of the clean-up following each patient visit. Clean all surfaces touched during a patient visit, including drawer pulls, handpieces, light handles, chair arms, suction hoses, switches, the headrest, and the air and water syringe. A moistened, but not dripping gauze pad is commonly used for this purpose.

Handscrubbing. Soap has limited antimicrobial activity and cannot be regarded as an effective antiseptic or disinfectant; however, it is a useful agent for the mechanical removal of bacteria from the skin by emulsification of fatty secretions in which micro-organisms are embedded.

Hexachlorophene is a significant exception to the general rule. The use of hexachlorophene-containing soaps results not only in an immediate reduction of the numbers of bacteria present on the skin but also the bacteriostatic activity of the residual hexachlorophene and, therefore, significantly inhibits the growth of bacteria on the skin.

Exercises (240):

1. What factors determine the effectiveness of a germicidal agent?

2. Name three purposes for using disinfectants.

3. What type of containers should be used for chemical agents?

4. How often should solutions be changed? Why?

5. What will a 2-percent solution of activated glutaraldehyde destroy?

6. What concentration of alcohol is effective against vegetative bacteria?

7. What disadvantages does alcohol have as a disinfectant?

8. What advantage does a mixture of iodophor-alcohol have over just alcohol alone?

9. What is sodium hypochlorite used for?

10. When should the "wipe-down" procedure be accomplished?

11. Are soaps considered effective antiseptics? Why?

Dental Anatomy, Physiology, and Histology

THE SUCCESSFUL dental specialist must obtain a thorough knowledge of oral anatomy, physiology, and histology. The knowledge is necessary whenever you complete dental treatment records and other related forms and as you discuss treatment procedures with dentists. Although you already have received training in the oral anatomy and physiology areas, this chapter will reinforce and add to your past training.

This chapter focuses on the cranial and facial bones of the skull, the structure and innervation of the oral cavity, the deciduous and permanent dentition, the structures of the teeth, and the oral mucosa and its function. The text begins with the bones and bony landmarks of the skull.

2-1. Bones and Bony Landmarks of the Skull

The skull is composed of 22 flattened or irregular bones. They are, with one exception (the mandible), immovably joined together. The bones of the skull are divided into two groups: the cranial bones, which protect the brain, and the facial bones, which make up the skeleton of the face. There are 8 cranial bones and 14 facial bones. All 22 bones are shown in foldout 2. Turn to this foldout located in the supplemental material to Volume 4 as we discuss these bones.

241. Given a list of cranial bones and their identifying features, match each bone with its identifying feature.

Cranial Bones. Cranial bones are either single or paired. Single bones are always found in the midline plane of the skull. Paired bones are found on either side of this plane and are mirror images of each other. There are eight cranial bones: frontal (single), parietal (paired), occipital (single), temporal (paired), sphenoid (single), and ethmoid (single).

Frontal. The frontal bone forms the forehead and is the largest cranial bone. It contains the frontal paranasal sinuses, which lie just above the sockets of the eyes. These paranasal sinuses are air cavities or accessory sinuses, located in the bones surrounding the nasal cavity. They communicate directly with the nasal cavity and their mucous linings are continuous with the nasal mucosa. The heavy ridge of bone found above the sockets of the eyes is the superciliary arch. It protects the eyes from any large object that may strike the face. Located on the lateral sides of the sockets of the eyes, the frontal bone attaches to the zygoma bones. The bony projections that extend from the frontal bone to the zygoma bones are called the zygomatic processes of the frontal bone.

Parietal. The two parietal bones form the larger portion of the top and sides of the skull. Each bone is shaped like the palm of the hand. Two lines are found on the external surface curving across the middle of each bone—the superior temporal line and the inferior temporal line. The inferior temporal line affords a place of attachment for the temporal fascia.

Occipital. The occipital bone lies in the back at the base of the skull. A large hole (foramen magnum) is formed in the base of this bone. It is through the foramen magnum that the brain connects with the spinal cord. Two convex, oval processes of bone called occipital condyles are situated on each side of the foramen magnum. The occipital condyles rest and move in the concave formation of the first cervical vertebra, or atlas, of the spinal column; they are the ''joint'' on which the skull turns. A projection of bone may be felt midway between the top and the base of this bone. This projection is called the external occipital protuberance. It is used as an anatomical landmark in taking certain extraoral radiographs.

Temporal. The two temporal bones are located at the sides and base of the skull. Each bone contains an organ of hearing. A projection from the center of the temporal bone that runs forward and connects with the zygoma bone is called the zygomatic process of the temporal bone. The zygomatic process makes up part of the zygomatic arch. A large heavy projection of bone just below and behind the ear serves as an attachment for several muscles responsible for the movement of the skull. This projection is the mastoid process. Just in front of the mastoid process is a long, thin projection of bone called the styloid process. One of the extrinsic muscles of the tongue attaches to the styloid process.

Sphenoid. The sphenoid bone, situated in the middle of the base of the skull, resembles a bat with extended wings. Paranasal sinuses called sphenoid air sinuses are found with this bone. The pituitary gland lies in a depression in the center of the sphenoid bone at the base of the brain. This is a saddle-shaped portion of the bone called the sella turcica (sea'-lah tur'-sic-kah). Two projections of bone extend downward from the inferior portion of the sphenoid bone. They are the pterygoid processes. The internal pterygoid and external pterygoid muscles attach to the pterygoid processes.

Ethmoid. The ethmoid bone lies in the anterior portion of the base of the skull. It forms the top part of the nasal septum. This bone also contains paranasal air spaces or sinuses.

Exercises (241):

1. Match each cranial bone listed in column B with its identifying feature in column A. Column B items may be used nore than once.

Column A

____ 1. Lies in the anterior portion of the base of the skull.
____ 2. Contains an organ of hearing.
____ 3. The largest cranial bone.
____ 4. Resembles a bat with extended wings. extended wings.
____ 5. Protects the eyes from large objects that may strike the face.
____ 6. The two bones form the large portion of the top and sides of the skull.
____ 7. The foramen magnum is formed in the base of this bone.
____ 8. Lies in the back at the base of the skull.
____ 9. The mastoid process is part of this bone.
____ 10. The pterygoid processes are part of the bone.
____ 11. It forms the top part of the nasal septum.
____ 12. The styloid process is a thin projection of this bone.

Column B

a. Frontal bone.
b. Pariental bone.
c. Temporal bone.
d. Sphenoid bone.
e. Ethmoid bone.
f. Occipital bone.

242. Identify the name, location, and features of the facial bones and the temporomandibular joint.

Facial Bones. The 14 facial bones are the zygoma (paired), nasal (paired), palatine (paired), inferior concha (paired), lacrimal (paired), vomer (single), maxilla (paired), and mandible (single).

Zygoma. The two zygoma bones form a large portion of the sockets of the eyes and the prominence of the cheeks. The temporal process of each bone forms the anterior portion of the zygomatic arch. The frontal process of each bone forms the lower portion of the lateral part of the sockets of each eye. The maxillary process of each bone extends from the prominence of the cheek to the maxilla.

Lacrimal. The two lacrimal bones lie inside the sockets of the eyes. Each bone contains part of the canal through which the tear duct passes. This is the thinnest and most fragile bone of the skull.

Nasal. The two nasal bones form the bridge of the nose. They connect with the frontal, ethmoid, and maxillary bones.

Palatine. The two palatine bones lie in the back part of the nasal cavity. The horizontal process of each bone forms the posterior one-third of the hard palate and floor and walls of the nasal cavity.

Inferior concha. The two inferior nasal conchae lie on the outer walls of the nasal cavity.

Vomer. The vomer forms the largest portion of the nasal septum.

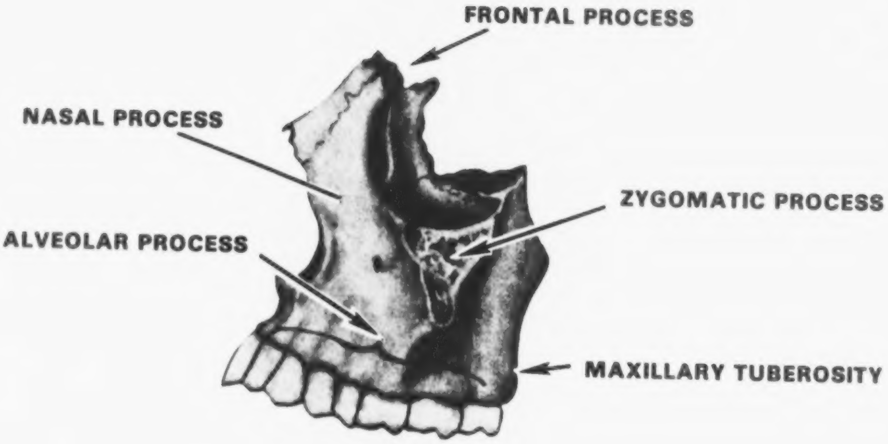
Maxilla. The two maxillary bones form the upper two-thirds of the face and support the upper teeth. Each consists of a body and four processes—zygomatic, frontal, alveolar, and palatine, as shown in figure 2-1. The maxillary sinus is located within the body of each maxilla. The walls of this large pyramid-shaped cavity are thin and in some cases the root tips of the posterior maxillary teeth extend into the sinus. When this occurs the lining membrane of the sinus is not perforated but merely follows the outline of the roots. The alveolar process is the thickest and most spongy part of the maxilla. The teeth are supported by this process. The palatine processes form the anterior two-thirds of the hard palate. The incisive foramen is located just behind the maxillary central incisors on the hard palate. Nerves that supply feeling to the anterior parts of the mucous membrane covering the hard palate come through this foramen. The heavy ridge of bone (the canine eminence) overlies the socket above the cuspid tooth. The perforation through the body of the maxilla just below the socket of the eye is the infraorbital foramen. Nerves that supply feelings to the upper portion of the cheek, side of the nose, and lower eyelid come through the infraorbital foramen.

Mandible. In this course we will consider the mandible as one of the facial bones, although some authorities consider the mandible as an individual bone because it is not connected to the other facial bones by suture lines. Rather, it is a separate bone articulating with the facial bones. The mandible is the largest and strongest bone of the face. It consists of the body, the curved horizontal portion, and two rami (the perpendicular portions). Each ramus unites with the end of the body at a right angle, known as the angle of the mandible. Views of the mandible are shown in figure 2-2.

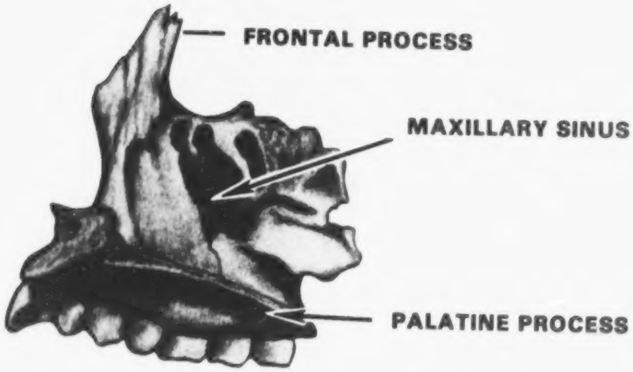
The perforations on each side of the facial surfaces of the body are the mental foramina. Nerves and blood vessels which supply the cheek and lower lip emerge through each mental foramen. The mylohyoid ridges are found on each side of the lingual surface of the body. The mylohyoid muscle attaches to these ridges—forming the floor of the mouth. The ridges extend from just behind the third molars almost to the midline. Behind the mandibular central incisors on the lingual surface of the body are small bony projections called genial tubercles. A fan-shaped extrinsic muscle of the tongue attaches to one set of these bony projections.

The mandibular foramen is on the lingual surface of the ramus. It is the opening into the mandibular canal. This canal contains inferior alveolar nerves, arteries, and veins which run through the canal from the mandibular foramen to the midline. A small bony projection, the lingula, partially covers the mandibular foramen.

Two bony projections are found at the top of each ramus. The anterior projection is the coronoid process, and the posterior projection is the condyloid process. The condyloid


FRONTAL PROCESS
NASAL PROCESS
ZYGOMATIC PROCESS
ALVEOLAR PROCESS
MAXILLARY TUBEROSITY

LATERAL


FRONTAL PROCESS
MAXILLARY SINUS
PALATINE PROCESS

MEDIAL

Figure 2–1. Views of the maxilla.

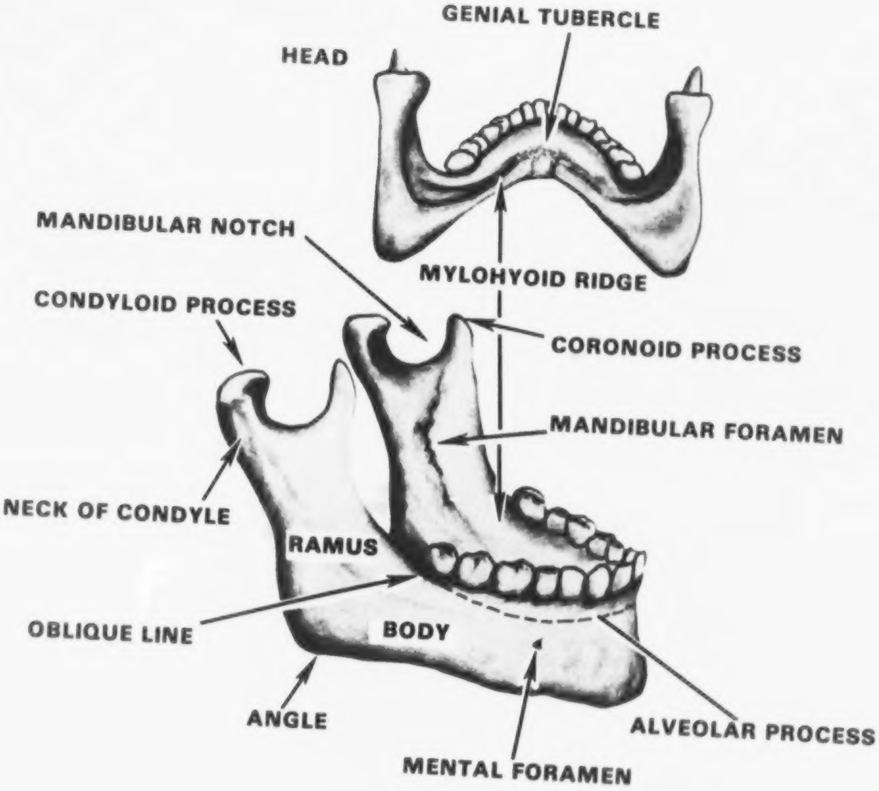

GENIAL TUBERCLE
HEAD
MANDIBULAR NOTCH
MYLOHYOID RIDGE
CONDYLOID PROCESS
CORONOID PROCESS
MANDIBULAR FORAMEN
NECK OF CONDYLE
RAMUS
OBLIQUE LINE
BODY
ANGLE
ALVEOLAR PROCESS
MENTAL FORAMEN

Figure 2-2. Views of the mandible.

processes are attached by the articular capsular ligament to the temporal bones to form the temporomandibular joint.

One type of joint is the movable junction of two bones. The gristle, or white elastic substance attached to joint bone surfaces, is called cartilage. The movement of bones is restricted by bands of fibrous tissue called ligaments. The temporomandibular articulation is a sliding hinge joint formed by the glenoid fossa of the temporal bone and the condyle or condyle process of the mandible. The temporomandibular articulation is shown in figure 2-3. The fossa is slightly cup-shaped and is limited anteriorly by a ridge, the articular eminence. This aids the ligaments of the joint in keeping the jaw from becoming dislocated. The articular surface of the condyle is oblong with the long diameter in a transverse plane. Between the condyle and the fossa is an interarticular disc of fibrocartilage. A capsular ligament encloses the joint in a fibrous sheath. Three of the strong fibrous ligaments—the temporomandibular, stylomandibular, and sphenomandibular ligaments—help to maintain the proper position of the condyle. A total of five ligaments are associated with the joint: the articular capsule, articular disc, and the temporomandibular, stylomandibular, and sphenomandibular ligaments.

a. The articular capsule attaches to the head of the condyle and the temporal bone. It completely encloses the head of the condyle and of the articular disc.

b. The articular disc divides the joint into two separate cavities. These cavities contain a fluid (the synovial fluid) that lubricates the joint.

c. The temporomandibular ligament is attached to the neck of the condyle and the zygomatic arch.

d. The stylomandibular ligament attaches to the angle and posterior border of the ramus of the mandibule and the styloid process of the temporal bone.

e. The sphenomandibular ligament attaches to the lingula of the ramus of the mandible and the sphenoid bone.

Exercises (242):

1. The two ____________ bones form a large portion of the sockets of the eyes and the prominence of the cheeks.
2. The lacrimal bones are the ___________ and ______________ ____________ bones of the skull.
3. The two nasal bones form the bridge of the nose and are connected with the _______________, ______________, and ____________ bones.
4. The two palatine bones lie in the __________ part of the nasal cavity. The ___________ process of each bone forms the posterior one-third of the hard palate.
5. The two inferior nasal conchae lie on the ______________ _____________ of the nasal cavity.
6. The ____________ forms the largest portion of the nasal septum.
7. The two __________ bones form the upper two-thirds of the face and support the upper _____________.
8. he four processes of each maxilla are ___________, __________, __________, and __________.
9. The _______________ ______________ is the thickest and most spongy part of the maxilla.
10. The perforation on the body of the maxilla just below the socket of the eye is the ______________ foramen.
11. The mandible consists of the body and two ____________.
12. Behind the mandibular central incisors on the lingual surface of the body are small bony projections called __________ __________.
13. The mandibular foramen is on the ___________ surface of the ramus.
14. The anterior bony projection at the top of each ramus is the ____________ process, and the posterior projection is the ____________ process.
15. The temporomandibular articulation is a _______________ _____________ joint formed by the ______________ fossa of the __________ bone and the condyle of the mandible.
16. The __________ ligament is attached to the neck of the condyle and the zygomatic arch.
17. The sphenomandibular ligament attaches to the _________ of the ramus of the mandible and the ___________ bone.

2-2. Muscles of Mastication and Facial Expression

Now that you have an understanding of the bones of the skull, with particular emphasis placed on the maxillae and mandible, it is appropriate that we discuss the muscles of mastication and facial expression.

243. Specify the origin, insertion, and action of the muscles of mastication.

Muscles of Mastication. There are four primary muscles of mastication which affect the movements of the mandible. Table 2-1 identifies these muscles and lists their origin, insertion, and action.

Masseter. The masseter (mas-e'h-tur) muscles are the most powerful of the muscles of mastication. They act to raise the lower jaw, thereby exerting pressure on the teeth, particularly in the posterior region. Figure 2-4 shows that the origin is the entire length of the outer surface of the zygomatic process of the maxilla and zygomatic bone. From this origin, the muscle fibers have a general downward and backward direction to their insertion on the lower border of the body of the mandible and facial surface of the ramus. If you clench your teeth, you can feel the movement of the masseter muscle around the angle of the mandible.

Temporalis. The temporalis is a muscle whose origin is a wide area on the sides of the head. This area includes the lower part of the parietal bone, the greater part of the temporal bone, the outer wing of the sphenoid bone, and the lateral surface of the frontal bone. The area of insertion of this muscle is the entire coronoid process and part of the anterior border of the mandible. The origin and insertion can be seen in figure 2-4. The fibers of the temporal muscles are quite long and spread over a large area. For this reason, the temporalis is mainly used for movement rather than power. Thus, it is used to raise the mandible;

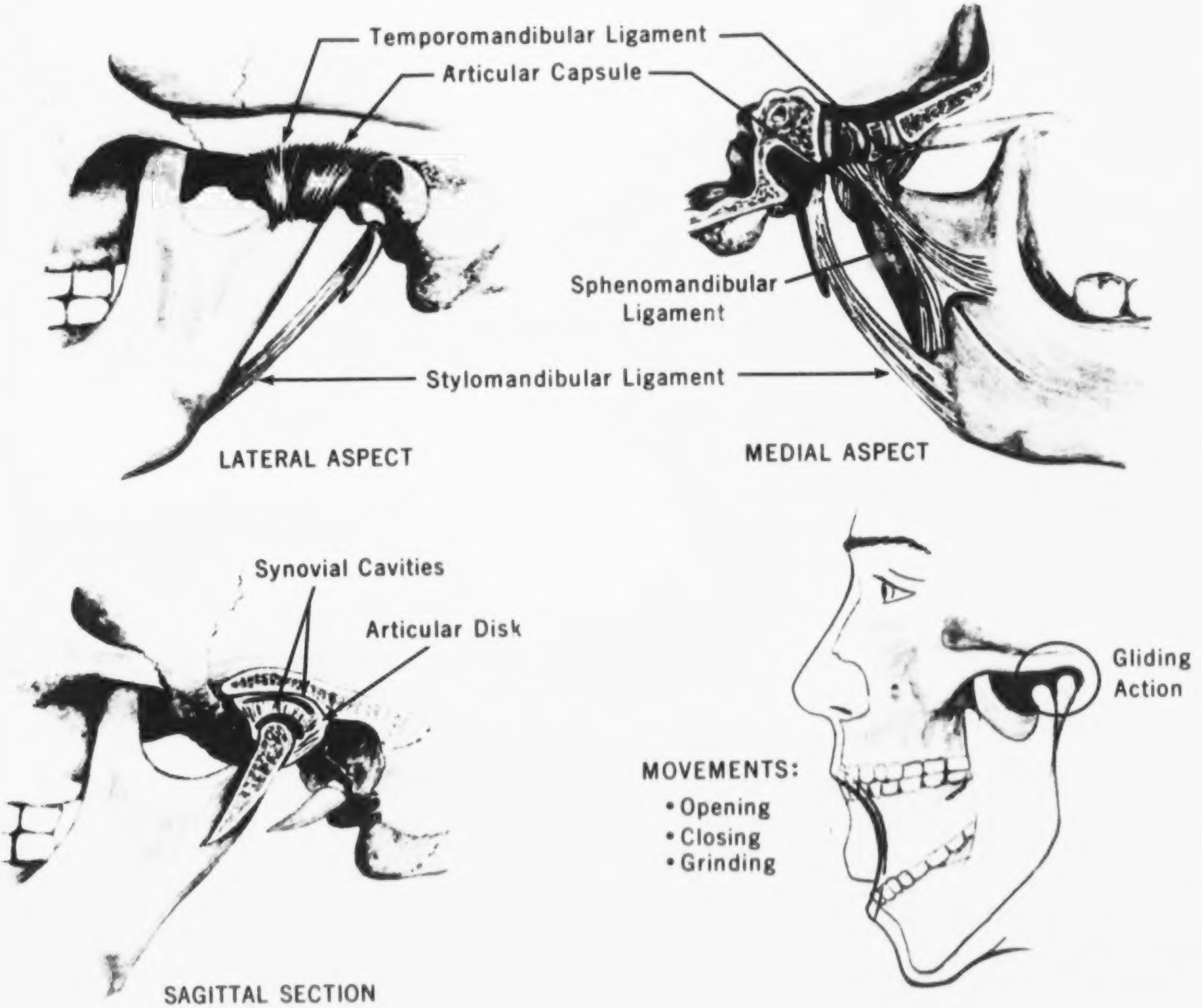

Temporomandibular Ligament
Articular Capsule
Sphenomandibular Ligament
Stylomandibular Ligament
LATERAL ASPECT
MEDIAL ASPECT
Synovial Cavities
Articular Disk
SAGITTAL SECTION
Gliding Action
MOVEMENTS:
• Opening
• Closing
• Grinding

Figure 2–3. Temporomandibular joint.

TABLE 2-1
MUSCLES OF MASTICATION

Muscle	*Origin*	*Insertion*	*Action*
Temporalis	Side of head	Coronoid process.	To raise the mandible and close the mouth.
Masseter	Zygomatic process	Facial surface of the angle of the mandible.	To raise the mandible and close the mouth.
Medial pterygoid	Sphenoid bone	Lingual surface of the angle of the mandible.	The simultaneous action of both medial pterygoid muscles moves the mandible upward and forward. When one medial pterygoid contracts, it moves the mandible to the side opposite that muscle.
Lateral pterygoid	Sphenoid bone	Condyloid process of the mandible.	The simultaneous action of both lateral pterygoid muscles moves the mandible downward and forward. When one lateral pterygoid contracts, it moves the mandible forward and to the side opposite that muscle.

and because of the oblique direction of the fibers, it also can retract the mandible. If you place your hand over the temporal bone, you can feel the action of this muscle as you open and close your mouth.

Medial pterygoid. The medial pterygoid, as seen in figure 2-4, acts as a counterpart to the masseter muscle. Its fibers follow the same general planes, and its function of raising the mandible is the same. It is located on the medial side of the ramus, with its origin being the medial surface of the lateral pterygoid plate. Its insertion is at the angular position of the mandible. Along with the masseter muscle, the medial pterygoid forms a sling to support the mandible.

Lateral pterygoid. Figure 2-4 shows the lateral pterygoid. It has its origin for two separate heads: the superior head arises from the lower part of the lateral surface of the great wing of the sphenoid and the inferior head from the lateral surface of the lateral pterygoid plate. The fibers from both heads converge in front of the temporomandibular joint and on the neck of the condyle. The action of the lateral pterygoid pulls the head of the mandible forward and inward. Thus, you can visualize that the function of this protruding muscle is to depress and move the mandible from side to side.

In addition to these primary muscles of mastication, there are several additional muscles that assist in the chewing of food. Three relatively large muscles form the floor, the sides, and the entrance to the oral cavity. These muscles can be seen in figure 2-5. They never act independently but always in unison with their related muscles.

Buccinator. The buccinator muscle must be considered in any discussion of the muscles of mastication, although it has little, if any, effect on the movement of the mandible. The buccinator forms the lateral walls of the mouth. Its primary action is to compress the cheeks; thus, it helps keep the food between the teeth during mastication. Its origin is the alveolar processes of both the maxillae and mandible. The fibers are directed forward to the angle of the mouth where they blend with the orbicularis oris. The fibers are divided at the angle of the mouth so that the upper fibers insert into the muscles of the lower lip and the lower fibers insert into the muscles of the upper lip. The buccinator muscle is pierced by the duct of the parotid gland and branches of the buccinator nerve.

Orbicularis oris. The orbicularis oris is a sphincter muscle has no definite origin or insertion. It is important because it completely encircles the mouth and forms the fleshy portion of the lips. It accomplishes the actions of closing the oral cavity, opening and protruding of the lips.

Mylohyoid. The mylohyoid muscle has its origin on the mylohyoid ridge. Its posterior fibers are directed downwardly and medially, with their insertion on the superior border of the hyoid bone. The middle and anterior

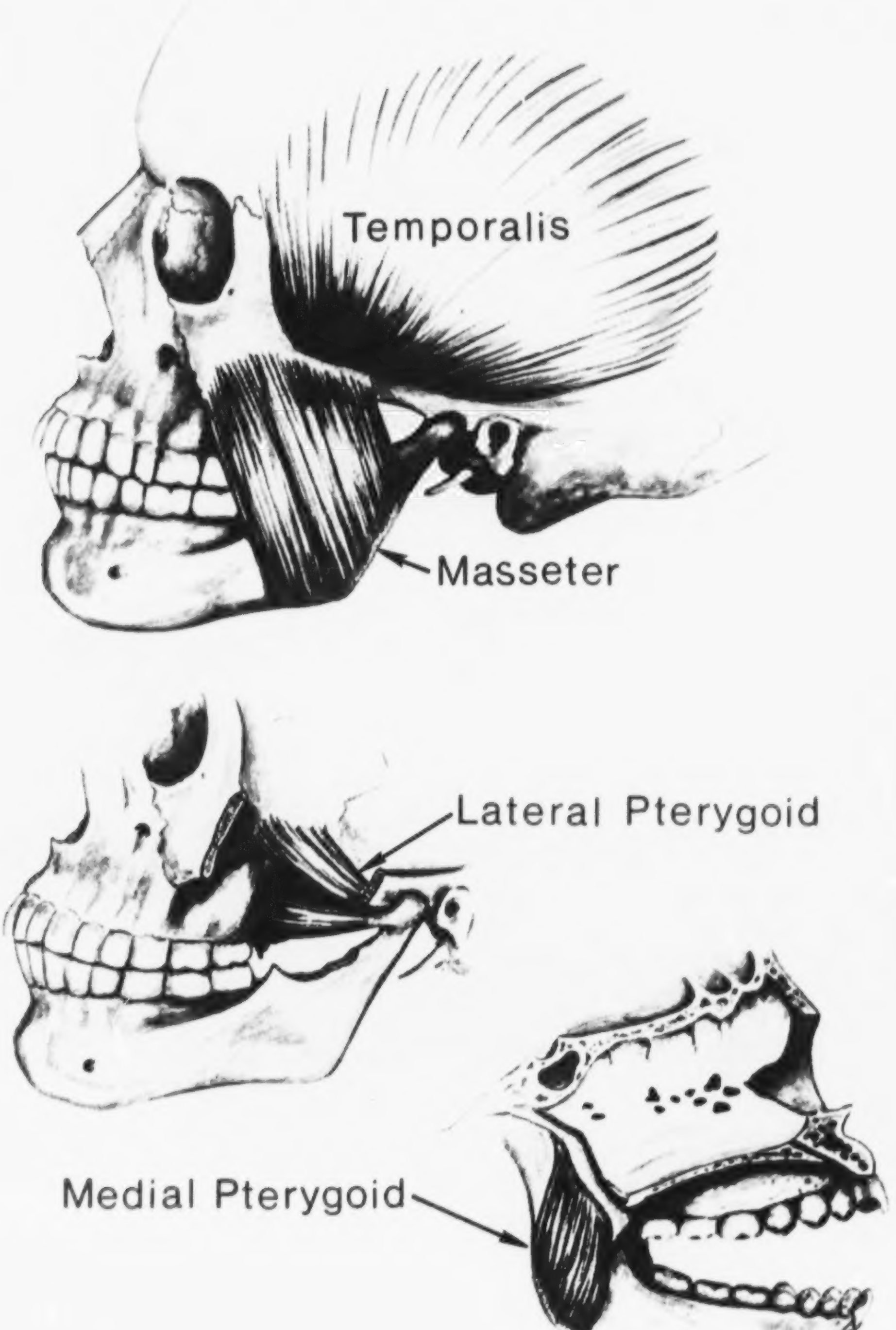

Temporalis
Masseter
Lateral Pterygoid
Medial Pterygoid

Figure 2–4. Primary muscles of mastication.

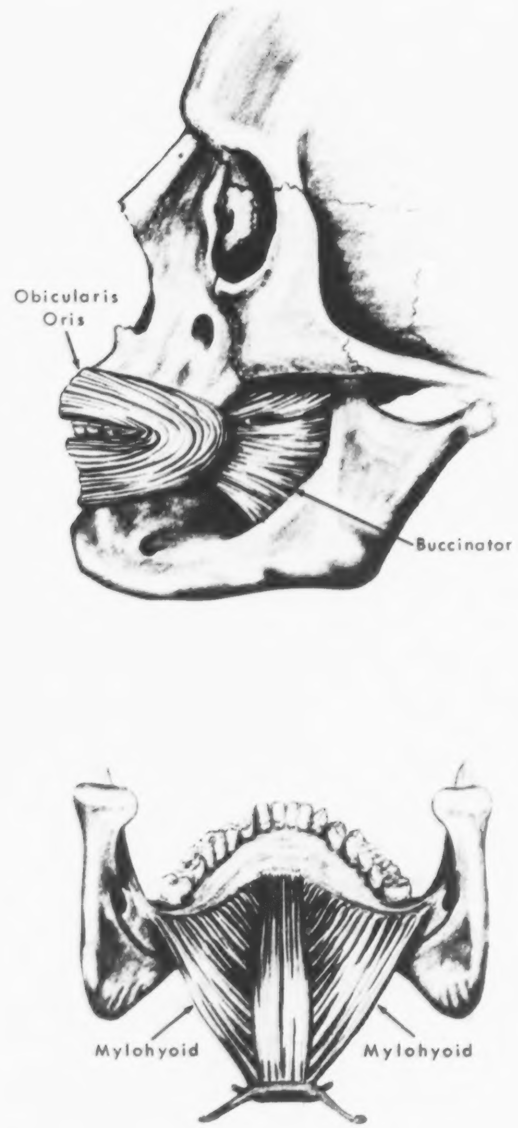

Obicularis
Oris
Buccinator
Mylohyoid
Mylohyoid

Figure 2–5. Related muscles of mastication.

fibers of the opposite mylohyoid muscle form the muscular floor of the mouth.

Exercises (243):

1. What is the action of the masseter muscles?

2. Where does the masseter muscle originate?

3. What is the origin of the temporalis muscle?

4. What are the two purposes of the temporalis muscle?

5. Where is the insertion of the medial pterygoid muscle?

6. What is the origin of the lateral pterygoid muscle?

7. What is the purpose of the buccinator muscle?

8. State the primary action of the buccinator muscle.

9. What objective does the orbicularis oris muscle accomplish?

10. Where is the mylohyoid muscle inserted?

244. Specify the location and cite the source of innervation of the facial muscles of expression.

Facial Muscles of Expression. Apart from the muscles of mastication, there is another group of muscles of interest to you. This group consists of the muscles of facial expression which lie under the superficial tissue of the head and neck. The muscles of facial expressions are supplied or innervated by the seventh cranial nerve. The action of these muscles produces the various changes in facial expressions that we observe on everyone. In view of the fact that these muscles of facial expression do not extend from one bony structure to another, they do not contribute to the displacement of fragments in fractures of the jaws and other facial bones. The action of the facial muscles also contributes to the formation of wrinkles in the skin of the face, and with increasing age, these wrinkles become permanent. The development of wrinkles should not be confused with folds in the skin, for these are produced by variations in the thickness of the skin and fat layers overlying the muscle bundles. The muscles of facial expression include the buccinator; the orbicularis oris (previously discussed); the mentalis, which rises and wrinkles the skin of the chin and pushes up the lower lip; and the zygomaticus major, which draws the angle of the mouth upward and backward.

Exercises (244):

1. Where are the facial muscles of expression located?

2. Which cranial nerve innervates the facial muscles of expression?

2-3. The Oral Cavity

The oral cavity, or mouth, is the entrance to the alimentary canal. It contains the organs of mastication, helps to perform the function of speech, and provides a special sense of taste. It is bounded in front by the lips, laterally by the cheeks, above by the hard and soft palates, and below by the mylohyoid muscle. It contains the teeth and tongue. The mouth opens anteriorly through the lips, and posteriorly, through the fauces (faw'seez) into the pharynx. The mouth is divided into two parts: (1) the vestibule, which lies between the lips, cheeks, and teeth; and (2) the mouth proper, which lies internally to the teeth. The bony framework of the mouth is formed by the maxilla, the palatine bones, and the mandibule. Our discussion of the oral cavity will be concerned with its innervation, the blood and lymph supply, the soft tissue structures, and the structures of the teeth.

245. Identify the functions of the trigeminal and facial nerves and their divisions.

Innervation of the Oral Cavity. The cranial nerves consist of 12 paired nerves which originate in the brain and supply definite areas of the body. Of these we are concerned with only two, the trigeminal and facial. Both nerves are mixed, which means they provide sensation and motor impulses to their respective areas of innervation. After leaving the cranium, both the trigeminal and facial nerves split into branches and have a wide distribution.

The trigeminal. The trigeminal, or fifth cranial nerve, is the main nerve supply of the oral cavity. Its major divisions are shown in foldout 3 (in the Volume 4 supplementary material). Notice how the trigeminal nerve arises from the brain and separates into three main divisions: the ophthalmic, the maxillary, and the mandibular.

The ophthalmic division. This nerve is entirely sensory and passes forward to enter the orbital cavity. Within the orbital cavity, it subdivides into branches that supply sensation to the tissue around the eye and the adjacent parts of the nose and forehead.

The maxillary division. This nerve leaves the skull through the foramen rotundum and enters the zygomatic fossa. This fossa gives off the *posterior superior alveolar branch*. This branch innervates the third molar, the second molar, and the lingual and distofacial root of the first molar. The remainder of the maxillary division passes forward into the orbital canal. While in the canal, two important branches, the *middle superior alveolar* and the *anterior superior alveolar*, are given off. The middle superior alveolar branch supplies innervation to the maxillary bicuspid teeth and the mesiofacial root of the first molar. The anterior superior alveolar branch serves the cuspid, the lateral incisor, and the central incisor. The last branching from the maxillary division of the trigemenal nerve is the point where it separates into three networks: the greater palatine, the lesser palatine, and the nasopalatine. All three palatine branches serve the lingual gingiva of the maxillary arch and the palate.

The mandibular division. This nerve is a mixed nerve that has both sensory and motor functions. It supplies sensory innervation to all the mandibular teeth, the mandibular gingiva, the inside of the cheek, and the tongue. In addition, it supplies motor impulses to all of the primary muscles of mastication, as well as to other muscles that are not a part of this discussion. It leaves the cranium through the foramen ovale, where it gives off the motor branch that innervates the muscles of mastication. The sensory branch that innervates the facial gingiva, the inner tissues of the cheeks, and the lingual branch to the tongue is also given off at this point. The remainder of the nerve enters the mandibular canal and innervates the mandibular teeth.

The facial. You need to understand one other cranial nerve, the facial nerve, shown in foldout 3,B. This is the seventh cranial nerve. Like the mandibular branch of the trigeminal, it is a mixed nerve. It supplies motor innervation to all the muscles of facial expression and sensory innervation to the tongue. The facial nerve leaves the skull through the internal auditory meatus. The sensation of taste is supplied to the tongue by a branch of the facial nerve called chorda tympani (kor'day-tim'pah nee). However, the main trunk of the nerve innervates the muscles of facial expression. This is accomplished when the facial nerve subdivides into its five terminal branches. These branches are the temporal, zygomatic, buccal, mandibular, and cervical. Each of these provides motor innervation in the region for which the branch is named.

Exercises (245):

1. What is the function of the ophthalmic division of the trigeminal nerve?

2. Which branch of the maxillary division innervates the third molar, the second molar, and the lingual and distofacial root of the first molar?

3. To what areas of the oral cavity do the three palatine branches of the maxillary division apply sensation?

4. What is the motor function of the mandibular division of the trigeminal nerve?

5. The facial nerve supplies sensory sensation to which part of the oral cavity?

6. Which regions are provided motor sensations from the five terminal branches of the facial nerve?

246. Specify the functions of the arteries, veins, and capillaries as they relate to the blood system of the oral cavity.

Vascular System of the Oral Cavity. The blood circulates to the oral cavity through a network of arteries, capillaries and veins. Through the vascular network, the tissues are nourished and the metabolic waste products are eliminated. Arteries, except for the pulmonary artery, are the vessels that carry oxygenated blood to the tissues. Veins, except for the pulmonary vein, carry blood containing carbon dioxide. Capillaries are those minute vessels that provide passage of blood from the arteries to the veins. Oxygen molecules escape through the walls of the arteries and capillaries into surrounding intercellular spaces; and carbon dioxide, water, and waste products are collected and carried away by the venous system.

Arterial system. The arteries carry blood from the heart to the tissues of the body. This arterial distribution is shown in foldout 4,A (in the supplementary material to Volume 4). The principal arteries that supply the head and neck are the common carotid arteries. These consist of both a right and left carotid artery, ascending within the tissues of the neck. At about the level of the hyoid bone, each common carotid divides into internal and external carotids. Refer again to foldout 4,A, and locate this division. The internal carotid enters the base of the skull and supplies the structures of the cranium. The external carotid, with its many branches, supplies the structures on the outside of the bony cranium. The external carotid, just above its division from the common carotid, gives off the lingual artery that supplies one-half of the tongue. The external maxillary artery is given off superior to the lingual artery and supplies the soft tissues of the side of the face and nose, the lip tissues, and the muscles. At about the level of the lower part of the ear, the external carotid divides into the two main terminal branches, the internal maxillary artery and the superficial temporal artery.

The facial artery is a branch of the external carotid and is sometimes referred to as the external maxillary artery. It enters the face at the inferior border of the mandible and can be detected by gently palpating (pressing on) the mandibular notch. It passes forward and upward across the cheek toward the angle of the mouth. Then it ascends along the side of the nose and ends at the medial commissure of the eye.

The internal maxillary branch supplies the bones of the jaws and the teeth and their supporting soft tissues. This artery is divided into four branches called the inferior alveolar artery, the posterior superior alveolar artery, the descending palatine artery, and the infraorbital artery.

a. The inferior alveolar artery is the first branch given off by the internal maxillary artery. It passes downward and enters the mandible through the mandibular foramen to supply the lower teeth and the substance of the bone. The mental artery, a branch of the inferior alveolar artery, exists through the mental foramen and supplies the chin.

b. The posterior superior alveolar artery is the next branch given off. It enters the maxillary bone posterior to the roots of the upper third molar. It passes through the bone to supply the molar and bicuspid teeth, the maxillary sinus, and the gingiva.

c. The descending palatine artery enters the palate by way of the palatine foramen. This artery supplies the soft tissues of the hard palate.

d. The infraorbital artery is the last branch of the internal maxillary artery. Just prior to coming out through the infraorbital foramen into the face, it gives off the anterior superior alveolar branch. This branch artery supplies the incisors and cuspids as well as the maxillary bone.

Venous system. The veins return the blood to the heart. They begin as small branches which unite and thus increase in size, as shown in foldout 4,B. The venous blood from the brain and internal structures of the cranium drains into venous channels called sinuses. These sinuses then empty into the internal jugular vein. The venous blood is returned from the oral and facial structures by two principal vessels. The superficial tissues are drained by the anterior facial vein, while the deep facial tissues are drained by the posterior facial vein.

The anterior facial vein follows the same general course as the external maxillary artery. It runs at an angle downward and backward across the border of the mandible to a point at the anterior border of the masseter muscle. At this point, the anterior facial vein and the posterior facial vein unite to form the common facial vein. The common facial vein, in turn, empties into the internal jugular vein.

The pterygoid venous plexus is a mass of veins constituting a dense network around and between the lateral pterygoid muscle and the temporal muscle. The plexus receives blood from veins draining the areas supplied by the branches of the internal maxillary artery. The blood is led away from the plexus by a short, wide trunk known as the internal maxillary vein. The internal maxillary vein connects with the posterior facial vein which, in turn, becomes the external jugular vein. Study foldout 4,B closely so that you will be thoroughly familiar with the location of these veins.

A possible route of infection into the brain can occur by way of the cavernous sinus. The external route is a wide-open system of veins leading directly into this sinus. Thus, any infection in the upper anterior teeth, the upper lip, the nose, or the eye can easily enter the brain by the venous system. The internal route, on the other hand, is a more complicated and slower means by which infections can spread to the brain by way of the cavernous sinus. Infections from the lower teeth, the upper posterior teeth, and the alveolar network may reach the cavernous sinus by way of the pterygoid plexus of veins. An infection in this cluster of veins may travel upward into the cavernous sinus when the venous blood is forced to back up from the pterygoid plexus during times of physical exertion. Since this is a slow process and does not produce any obvious symptoms until the brain is infected, extreme care must be taken with any infections in these areas.

Exercises (246):

1. The blood circulates to the oral cavity through a network of ____________, ____________, and ____________.
2. The arteries, except for the pulmonary artery, are the vessels that carry __________ blood to the tissues.
3. The principal arteries that supply the head and neck are the ____________ ____________ arteries.
4. The external carotids, just above their division from the common carotids, give off the __________ __________, which supplies one-half the tongue.
5. The __________ __________ artery enters the mandible through the mandibular foramen to supply the lower teeth and the substance of the bone.
6. The posterior alveolar artery enters the maxillary bone ____________ to the roots of the upper third molar. It passes through the bone to supply the ____________ and ____________ teeth.
7. The common facial vein empties into the ____________ jugular vein.
8. Infections from the lower teeth, the upper posterior teeth, and the alveolar network may reach the cavernous sinus by way of the ____________ ____________ of veins.

247. Cite the functions of the lymph system and list three factors which influence the flow of lymph.

Lymph System of the Oral Cavity. The head and neck are well supplied with a lymphatic system. The basic component parts of this system are the lymph, the lymph vessels, and the lymph nodes. Lymph is an almost colorless liquid similar in composition to blood plasma. The lymph fluid is derived from the blood plasma as it leaks into the spaces between the tissue cells. This system functions to combat bacterial infections by transporting disease-producing organisms to the lymph nodes, carries off excessive fluid from the body tissues, and acts as a supplement to the venous system.

The flow of lymph through the network of lymph vessels is influenced by three factors: (1) the difference in pressure at the two ends of the system; (2) the valves in the lymph vessels, which prevent the backflow of the lymph; and (3) the contraction and relaxation of the muscles. The flow of the lymph always is toward the heart.

The lymph vessels resemble the veins in that they start as small vessels and have the same type of duct linings as veins. The lymph vessels collect the lymph from the tissue spaces and then unite to form large vessels. With the increase in size, the walls become stronger, and they are very similar in structure to the veins. The tributaries from the left side of the head and neck drain into the thoracic duct, which empties into the left subclavian vein.

The lymph nodes are small oval-shaped bodies that lie along the course of the lymph vessels. Usually, they occur in groups and act as filters to remove bacteria and other foreign particles from the lymph system. Lymphocythes originate at the lymp nodes. Figure 2-6 is a diagrammatic illustration showing the lymph system of the head and neck.

Exercises (247):

1. Cite the essential functions of the lymph system.

2. What three factors influence the flow of lymph through the network of lymph vessels?

248. Identify the types of oral mucosa in terms of their functions, structures, and locations.

The Mucous Membrane (Mucosa). The mucous membrane lining the mouth is continuous posteriorly with the mucous membrane of the pharynx; it anteriorly blends with the skin of the face. Many mucous glands are distributed throughout this mucous membrane. While this membrane is similar in composition to the skin, it is softer and less tough. It is made up of two layers, the epithelium and an underlying connective tissue. A loose submucosa contains a series of glands to bathe the mucous membrance with serous or mucous secretions. In the hard palate, these glands are found at the base of the epithelial layer, since there is no submucosa on the hard palate. Within the range of normality, there are rather wide variations in gingival color, dependent upon differences in complexion and ethnic differences. Oral mucosa is divided into three types: masticatory, specialized, and lining.

Masticatory mucosa. Masticatory mucosa is tightly bound to the underlying bone, as for example, the hard palate and attached gingiva. A microscopic cross section of the mucosa would reveal a thick epithelium and a thin connective tissue. Masticatory mucosa is stippled. It also is tightly bound down, and there is no indication of elastic fibers that permit tissue to stretch or expand. The tissue is obviously keratinized (of a hornlike or scaly composition).

Specialized mucosa. Mucosa that has been developed for the purpose of taste perception is called specialized mucosa. There are four divisions of specialized mucosa: the filiform, the fungiform, the foliate, and the circumvallate papillae.

a. The filiform are thread-shaped papillae on the dorsal surface of the tongue. They are the smallest, most numerous and provide the sense of touch.

b. Fungiform are mushroom-shaped papillae located on the tip and along the sides of the tongue. Those located on the tip of the tongue are responsible for the sensations of sweetness and saltness. The fungiform located along the sides of the tongue are partially responsible for the sensations of sourness and saltness.

c. Foliate papillae also are partially responsible for detecting the sensation of sourness. The mucous membrane is very thin along the margins of the tongue and on the posterior part of each margin can be found a variable number of vertical folds. These folds are collectively called foliate papillae.

d. Circumvallate papillae are larger mushroom-shaped papillae located on the posterior dorsum of the tongue. These papillae are usually arranged in an inverted "V" formation, and they number from 8 to 12. These "taste buds" are responsible for the sensation of bitterness.

Lining mucosa. Lining mucosa is found on the floor of the mouth, the lining of the cheeks, the covering of the lips, and the soft palate. It has a thin epithelium and connective tissue. There is no stippling nor is it keratinized. This mucosa has an abundant supply of elastic fibers, thus allowing for free movement and elasticity.

Exercises (248):

1. Match each type of mucosa in column B with the appropriate descriptive statement in column A. Some items in column B may be used more than once.

Column A

____ (1) The tissue is keratinized (of a hornlike composition).
____ (2) This mucosa has an abundant supply of elastic fibers allowing for free movement and elasticity.
____ (3) This mucosa is divided into four divisions.
____ (4) Mushroom-shaped papillae located on the tip and along the sides of the tongue.
____ (5) Thread-shaped papillae located on the dorsal surface of the tongue.
____ (6) The collective vertical folds located on the posterior part of each margin of the tongue contains these papillae.

Column B

a. Masticatory mucosa.
b. Specialized mucosa.
c. Filiform papillae.
d. Fungiform papillae.
e. Foliate papillae.
f. Circumvallate papillae.
g. Lining mucosa.

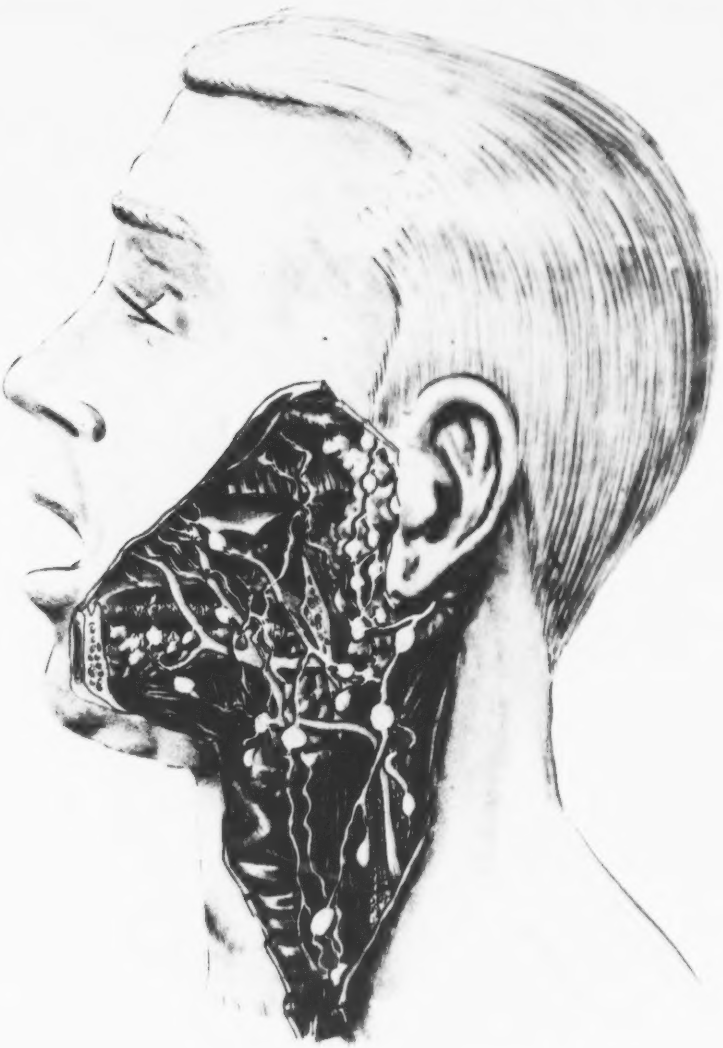


Figure 2–6. Lymphatic system of the head and neck.

Column A	*Column B*
____ (7) These papillae are usually arranged in an inverted "V" formation numbering from 8 to 12.	
____ (8) Responsible for the sensation of bitterness.	
____ (9) Taste buds are located at the base of these pappillae and are the main source of taste sensation.	
____ (10) These papillae located on the tip of the tongue are responsible for the sensations of sweetness and saltness.	

249. Cite the functions and locations of the structures of the oral cavity.

Structures of the Oral Cavity. The oral cavity is the first subdivision of the digestive system, and this chapter will highlight many of its structures. For clarity, we will begin with the two major parts of the mouth.

The vestibule. The vestibule is the space bounded above and below by the folding of the mucous membrance from the lips and cheeks onto the gingiva of the maxillae and mandible. This reflection of tissue is known as the mucobuccal fold and can be seen in figure 2-7. Consideration of the fold is very important when constructing dentures. If the borders of the dentures are overextended in the mucobuccal fold area, they will impinge upon the tissue, causing inflammation and soreness. To explore the vestibule limits, place you teeth together and push your index finger along the outer surface of the teeth; move your finger upward and downward as far as possible. Your finger will be in the vestibule.

We must consider both the upper and the lower labial frena when discussing the vestibule. These are sickle-shaped extensions of connective tissue that connect the lips to the alveolar ridges. This connection tends to restrict the lip movement. When dentures are being constructed, grooves must be made in the acrylic to adequately accommodate these frena.

The lips are the fleshy folds of tissue around the opening of the mouth. The orbicularis oris muscle encircles the mouth and is a major contribution to the lip formation. The lip borders are the points where the mucous membranes of the oral cavity meet the skin of the face.

The cheeks are made up of muscles and fibroelastic tissue, with the outer surface covered by skin and lined internally with mucous membrane. Two pairs of muscles of mastication, the masseter and the buccinator, contribute to the cheek formation. However, the buccinator muscles form the innermost muscular layer of the cheeks and force the food between the teeth from the facial side during mastication. The cheeks extend both upward and downward to the line where the mucous membrane turns back on the alveolar process. When the teeth are in occlusion, there remains a space distal to the last molars. The posterior

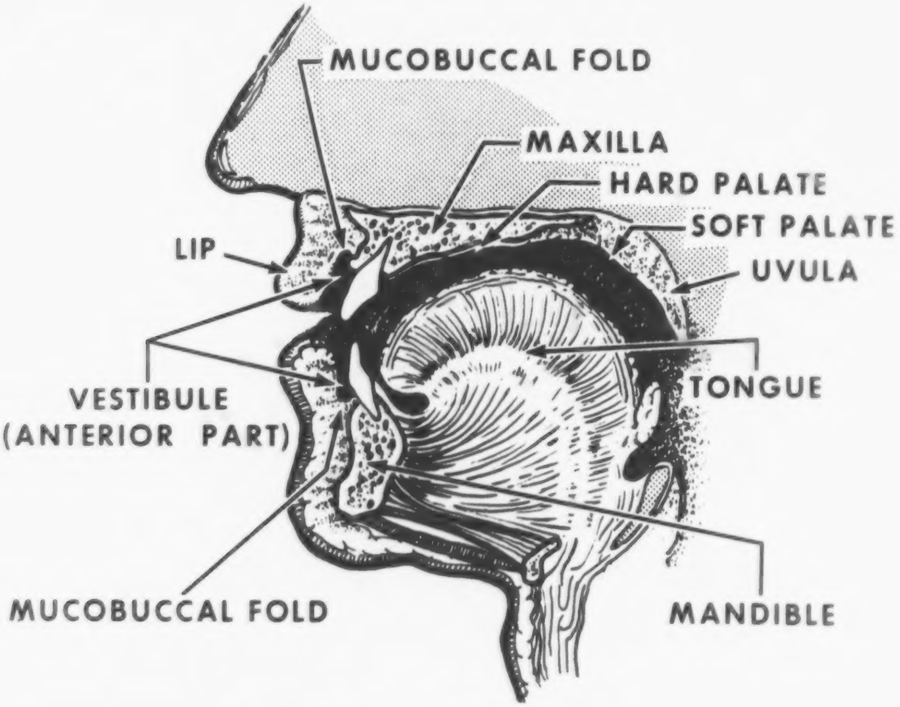


Figure 2-7. Cross section of the oral cavity.

boundary of the cheek is the pterygomandibular raphe (rah-fay'). This raphe connects the upper and lower alveolar processes in that space behind the last teeth, as shown in figure 2-8.

The palate: The anterior two-thirds of the arch-shaped roof of the mouth is formed by the hard palate, as shown in figure 2-9, and it is referred to as the palatal area. The arch shape is formed by the palatal process of the maxilla. The hard palate is covered with a mucous membrane that adheres closely to the maxilla. The incisive papilla is located just behind the central incisors in the anterior region of the hard palate. The papilla covers the incisive foramen through which the nerves and blood vessels pass. Posterior to this area, the mucous membrane is drawn into irregularly shaped ridges called rugae (roog'eye), which extend laterally from the midline. These transverse ridges aid in mastication by providing a working surface for the tongue to make food into a ball for swallowing. The soft palate is continuous with the hard palate. It is composed chiefly of muscles covered with mucous membrane. The vibrating line is located at the junction of the hard and soft palates. Along the vibrating line and near the midline are two small depressions called the foveae palatine (foe'-vee-eye pal-ah-teen'-eye). Behind the maxillary third molar are two landmarks—the maxillary tuberosity and the hamular notch. The conical-shaped mass of tissue that hangs from the free border of the soft palate is the uvula.

The floor of the mouth is formed by the mylohyoid muscles and the tongue. The tongue almost covers the entire floor of the mouth. Only when the tip of the tongue is raised are you able to see the portion formed by the mylohyoid muscle. Also visible when the tip of the tongue is in its raised position is the lingual frenum, which connects the undersurface of the tongue to the floor of the mouth. On each side of the lingual frenum are the sublingual caruncle. The submandibular salivary glands secrete into the oral cavity through these caruncle.

The tongue itself is a muscular organ covered with mucous membrane. It is divided into the tip, the body, and the root. The tip lies almost free, while the body is attached to the mandible at the side. The body is movable but not as much as the tip. If you look posteriorly along the dorsum of the tongue, you will notice that the root becomes less

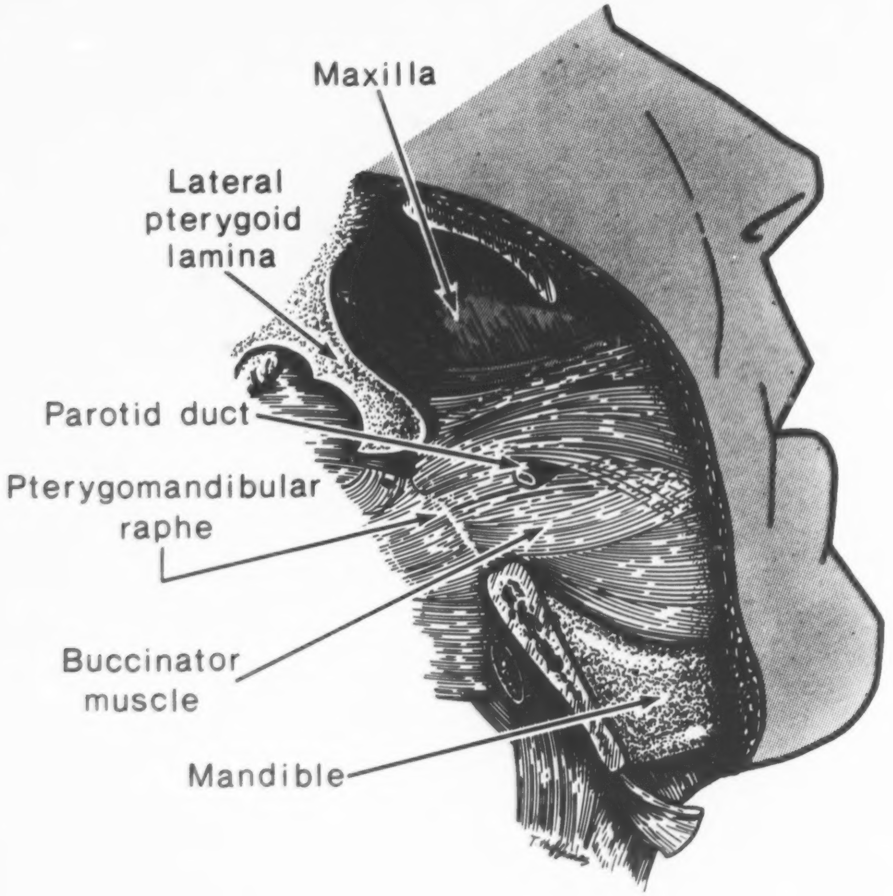


Figure 2-8. The cheeks

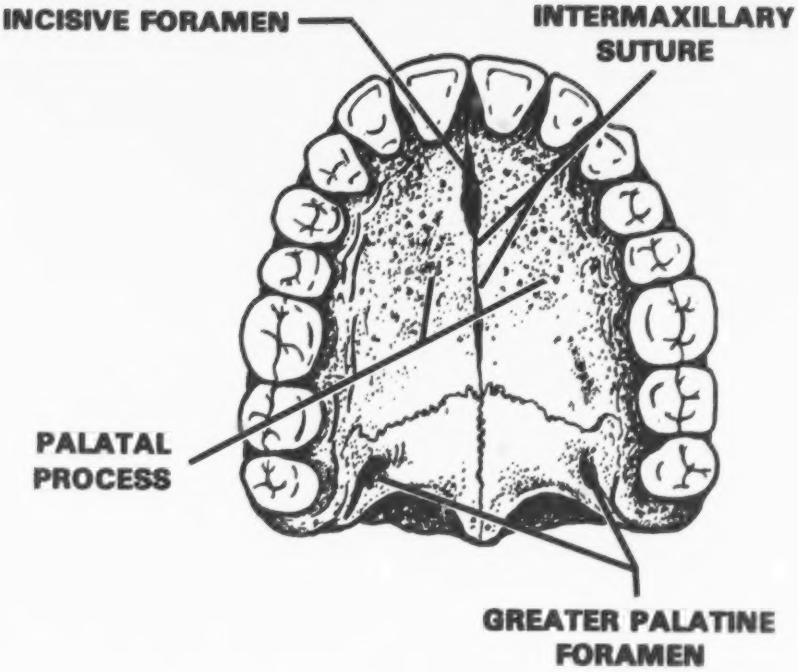

INCISIVE FORAMEN
INTERMAXILLARY SUTURE
PALATAL PROCESS
GREATER PALATINE FORAMEN

Figure 2–9. The palate.

defined until it finally becomes continuous with the soft tissue structure in the mouth.

The muscles that control movement of the tongue are both intrinsic and extrinsic. The intrinsic muscles have both their origin and insertion in the tongue. The extrinsic muscles have their origin outside the tongue but insert into the tongue. Both the intrinsic (fig. 2-10,A) and the extrinsic muscles (fig. 2-10,B) are illustrated. Use this figure in conjunction with tables 2-2 and 2-3, which show the origin, insertion, and action on the tongue of these muscles.

During the process of mastication, the tongue assists in positioning the food between the teeth. After the food has been sufficiently chewed, the tongue transforms it into a bolus so that it can be swallowed. After eating, the tongue helps to clean the surfaces of the teeth and, of course, without the tongue there would be no speech.

Although they are not a part of the vestibule or the mouth proper, major salivary glands, divided into three pairs, empty their saliva into the oral cavity. These parts are the parotid, the submandibular, and the sublingual. The parotid glands, which are the largest of the salivary glands, lie in the cheeks just in front of the ear. They empty their secretions into the oral cavity through the parotid or Stensen's ducts. The openings of the ducts are opposite the maxillary second molars. The opening of a parotid duct is usually marked by the parotid papilla. The submandibular glands (sometimes called submaxillary glands) are located below the mandible, medial and inferior to the parotid gland. These glands discharge their secretion through the submaxillary or Wharton's ducts into the floor of the mouth on each side of the lingual frenum. The sublingual glands

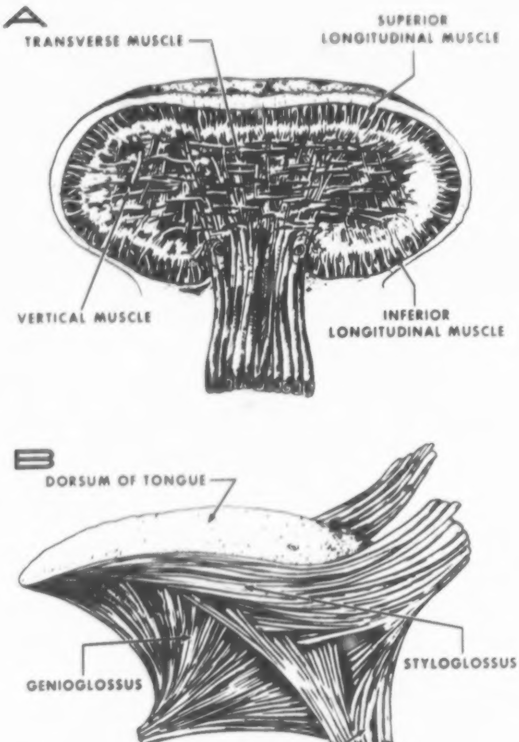

A
TRANSVERSE MUSCLE
SUPERIOR LONGITUDINAL MUSCLE
VERTICAL MUSCLE
INFERIOR LONGITUDINAL MUSCLE
B
DORSUM OF TONGUE
STYLOGLOSSUS
GENIOGLOSSUS
HYOGLOSSUS

Figure 2–10. Muscles of the tongue.

TABLE 2-2

INTRINSIC MUSCLES OF THE TONGUE

Muscle	*Origin*	*Insertion*	*Action on Tongue*
Superior longitudinal	Near the epiglottis and median septum	Runs forward to edges of the tongue.	Shortens, turns tip and edges up.
Inferior longitudinal	Root of the tongue	Tip of the tongue.	Shortens, turns tip and edges down.
Transverse	Median septum	Sides of the tongue.	Narrows and elongates.
Vertical	Upper surface	Under surface.	Flattens and broadens.

are located beneath the tongue. They are the smallest of the three major saliva glands. Many small sublingual ducts empty the sublingual gland's secretions onto the floor of the mouth. Other glands empty through the same duct that drains the submandibular glands. Refer to figure 2-11 for the location of the major salivary glands.

Exercises (249):

1. Where is the vestibule located?

2. What is the function of the buccinator muscles?

3. Where is the pterygomandibular raphe located?

4. How do the rugae aid in mastication?

5. Where is the uvula located?

6. How does the uvula affect speech?

7. In which major part of the oral cavity is the tongue located?

8. Where are the parotid salivary glands located?

TABLE 2-3

EXTRINSIC MUSCLES OF THE TONGUE

Muscle	*Origin*	*Insertion*	*Action on Tongue*
Genioglossus	Superior genial tubercle	Under surface of tongue from apex to root.	Protrudes and depresses.
Styloglossus	Styloid process	Posterior dorsum of the tongue.	Upward and backward.
Hyoglossus	Greater cornu and body of the hyoid	Side of the tongue.	Depresses and turns edges down.

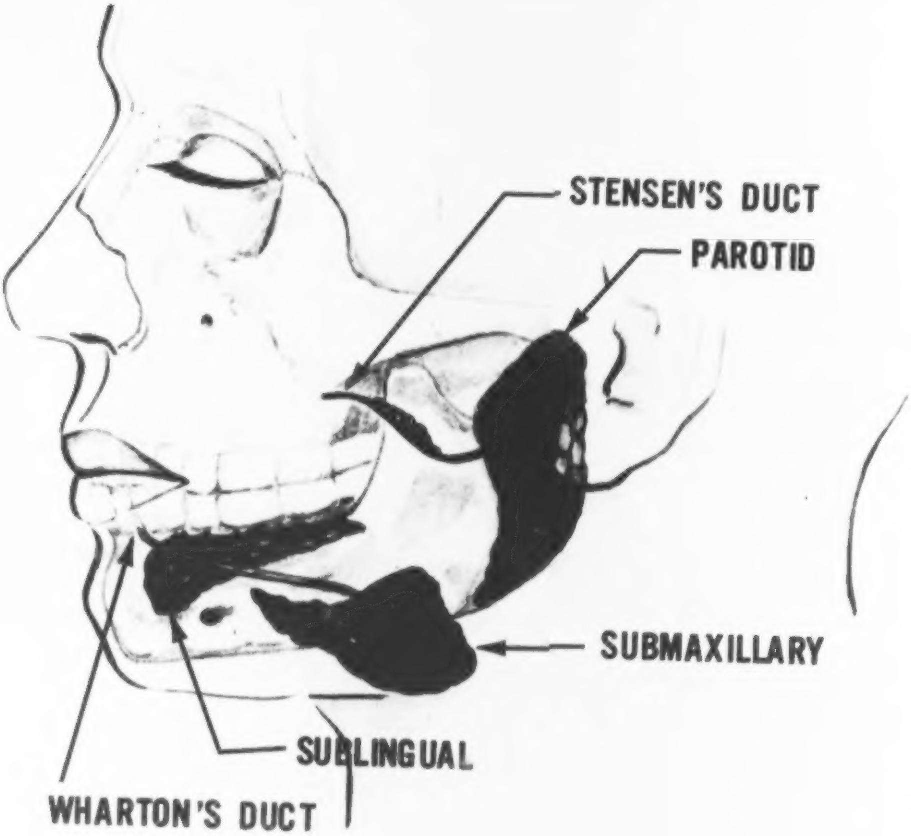

STENSEN'S DUCT
PAROTID
SUBMAXILLARY
SUBLINGUAL
WHARTON'S DUCT

Figure 2-11. Major salivary glands.

9. Where are the openings of the Stensen's ducts?

2-4. Dental Histology

Histology is the microscopic study of the structural elements of an organism or its parts. Thus, dental histology deals with the microscopic study of dental tissues. This section will focus on the teeth and their supporting structures.

250. Identify the parts and tissues of the teeth.

Tissues of the Teeth. Each tooth has a crown and a root portion. The crown is that part of the tooth which may be seen protruding from the gingiva in the normal healthy mouth. The root is that part of the tooth which is normally present in the gingiva and alveolar bone structures. The narrow portion of the tooth, where the crown and root meet, is called the neck or cervix. The tip of the root is its apex. If you were to section a tooth in a longitudial plane, you would see that the crown and the root each consists of two layers of hard substances surrounding the dental pulp. The outer layer of the crown is made of enamel. The layer beneath the enamel is called dentin. The outer layer of the root is covered by a substance called cementum, and its inner layer is dentin. In the innermost portion of the tooth there is a chamber that contains the dental pulp which is composed of nerves, blood vessels, lymph vessels, and connective tissue. This chamber is known as the pulp cavity. The anatomical structures of a tooth can be seen in foldout 5,A (in the supplementary material to Volume 4). When a tooth erupts into the mouth, a membrane called the enamel cuticle or primary cuticle covers the entire crown. Mastication and brushing the teeth soon wear this cuticle away on the exposed surfaces. However, it may remain in protected areas until mechanically removed during dental treatment.

Enamel. Enamel is the hardest calcified tissue in the human body. It covers the entire crown and protects the underlying structures. It is composed of 96 to 98 percent inorganic materials, principally calcium and phosphorus, and from 2 to 4 percent organic materials. As seen in foldout 5,B, the structural composition of enamel consists of rods, or prisms, which are bound together by an intercementing substance. Each enamel rod extends from the junction of the enamel and dentin to the outer surface of the tooth. As the enamel is formed, brief pauses in its development cause areas of diminished calcification. These appear as narrow, brown lines when viewed under a microscope. The lines are comparable to growth rings in a tree trunk. They are called lines of Retzius for the man who discovered them. Narrow cracks may develop in the enamel in planes of tension either during development or after the enamel is formed. These cracks become filled with organic materials and are known as enamel lamellae (lah-mell'-eye). A lamella may extend from the outer surface of the enamel toward the dentinoenamel junction. In some instances, it reaches the junction or even penetrates the dentin.

Specialized cells called ameloblasts form enamel. After the ameloblasts have formed the enamel, they degenerate and disappear. Therefore, after the enamel has been formed it has no regenerative power.

Dentin. Dentin is the second hardest calcified tissue in the human body and forms the major portion of a tooth. It is composed of approximately 70 to 80 percent inorganic material and 20 to 30 percent organic material. As with enamel, the main constituents of the inorganic material are calcium and phosphorus.

Cells called odontoblasts form dentin. The dentin that is formed during tooth formation is called primary dentin. Dentin consists of dentinal tubules held together by a calcified matrix. The structures of dentin can be seen in foldout 5,C. Study this figure as the discussion of the dentin is presented. The dentinal tubules appear as hollow tubes. They extend from the dentinoenamel junction to the surface of the pulp chamber. Odontoblasts, cells which produced the dentinal tubules, are found at the pulp chamber surface. They are active cells, since they still receive nourishment from the blood vessels in the pulp tissue. On occasion, the tubules may extend past the dentinoenamel junction and terminate in the enamel. Each of these tubules contain a cytoplasmic extension of the odontoblast. These extensions are known as Tome's fibers.

It is theorized that Tome's fibers transmit pain impulses from the dentin to the pulpal nerves located adjacent to the odontoblasts, since nerve fibers never have been identified within the dentin. Mechanical stimuli, such as those produced by dental burs, produce pain in the dentin. Thermal, bacterial, or chemical stimuli may cause pain at any level within the dentin. Continuous stimuli from any of these methods will cause the odontoblasts to become again active and thereby recommence to produce dentin.

These later deposits or formations of dentin are called secondary dentin. The production of secondary dentin is possible because of the odontoblasts that have remained to line the walls of the pulp chamber and canal ever since the tooth's formation. The formation of secondary dentin usually occurs in response to an external irritation, such as dental caries, chemical or thermal stimuli. The layer of secondary dentin is produced in an attempt to protect the vital pulp tissues.

Cementum. Cementum is a thin layer of bonelike tissue covering the roots of the teeth. The structures of the cementum can be seen in foldout 5,D (in the supplementary material to Volume 4). It is composed of approximately 55 percent organic material and 45 percent inorganic material. The organic material is primarily composed of collagen (kahl'-a-jen). This collagen is present in all connective tissue and dissolves into gelatin when boiled. The cementum and enamel usually meet each other at the cervix of the tooth at a point called the cemento-enamel junction.

Cementoblast produce a cementum cover over the dentin located in the root portion of the teeth. As they produce the cementum, connective tissue extensions from the surrounding tissues are imprisoned in the cementum. These extensions are the fibers of the periodontal ligament. Normally, there are two layers of cementum present on the root. Because it contains no cells, the inner layer, or the layer next to the dentin, is called the acellular layer. The outer layer is a cellular layer because it contains the remains of the cementoblasts. Removal of the cellular layer by mechanical means such as tooth scaling will result in a loss of cementum.

The principal function of cementum is to serve as an attachment for the periodontal fibers that anchor the teeth to the bony walls of their sockets. The cementum is formed throughout the life of the tooth. This continuing formation compensates for growth of the tooth into the oral cavity and movement of the tooth by external forces. The process allows the periodontal fibers to continuously reattach themselves to the root surface so that the teeth may be moved and still remain firmly seated in the alveolar bone.

Dental pulp. The dental pulp is the vital center of a tooth. The center pulp is shown in foldout 5,E, in the supplementary material to Volume 4. It is a soft tissue composed of loose, connective tissue containing numerous nerves, blood, and lymph vessels. All of these tissues enter through a small opening in the apex of the tooth called the apical foramen. The entire dental pulp is enclosed within the hard, unyielding walls of the pulp chamber and the canal. The pulp chamber is located within the crown while the pulp canal is within the root of the tooth.

Formation of dentin is the primary function of the dental pulp. The pump also provides nourishment to the dentin through the odontoblastic extensions that are located along the entire pulp chamber and canal. The nerve tissue in the pulp respond to sensations and irritations exerted upon the whole tooth. irritation of the pulp tissue causes the odontoblasts to form secondary dentin. Irritation to the tooth also will cause the blood vessels to expand, resulting in inflammation. Since the pulp tissue is enclosed within solid walls that do not allow for expansion of the pulp tissue, swelling due to inflammation may result in the death of the pulp tissues by strangulation. This inflammation occurring in a nonexpandable chamber is the reason for excessive dental pain.

Exercises (250):

1. Match the terms in column B with the appropriate statement in column A. Some of the terms may be used more than once.

Column A

____ (1) That part of a tooth normally present in the gingiva and alveolar bone structure.
____ (2) The narrow portion of tooth where the crown and root meet.
____ (3) The hardest calcified tissue in the human body.
____ (4) That innermost part of the tooth that provides space for nerves and blood vessels.
____ (5) That part of the tooth that protrudes from the gingiva.
____ (6) When viewed microscopically these resemble the narrow brown rings of a tree trunk.

Column B

a. Nexk or cervix.
b. Enamel.
c. Root.
d. Pulp chamber.
e. Crown.
f. Enamel cuticle.
g. Dentin.
h. Lines of Retzius.
i. Apex.
j. Dental pulp.
k. Cementum.

Column A *Column B*

____ (7) The second hardest calcified tissue in the human body; it forms the major portion of a tooth and appears to be light yellow.
____ (8) The vital center of a tooth.
____ (9) A membrane that covers the entire crown of a newly erupted tooth.
____ (10) Functions to form and nourish detin.
____ (11) A thin bonelike tissue that covers the outer layer of the root.
____ (12) Covers a tooth's entire crown and protects its underlying structure.
____ (13) The layer beneath the enamel.

251. Identify, by name, function, and location, the tissues surrounding the teeth.

Tissues Surrounding the Teeth. The tissues that surround and support the teeth are known as the periodontium and include the periodontal ligament, the alveolar process, and the gingiva.

The teeth are embedded in the bony sockets of the alveolar processes, the entire function of which is to support the teeth. The periodontal fibers attach to both the cementum of the tooth and the alveolar process. The function of the periodontal fibers is to hold the teeth in a semirigid state. The gingiva consists of the free gingiva and the attached gingiva. The following descriptions of the individual tissues will more fully explain the relationships of the tissues to the teeth.

Periodontal fibers. The periodontal ligament completely surrounds the root of the tooth and attaches it to the wall of the bony socket. The functions of the periodontal ligament are support, sensation, nutrition, and formation. The fibers support the tooth within the socket. The nerves and blood vessels provide sensation and nutrition to the cells of the ligaments. The formative function is building and maintaining cementum. Fibroblasts produce the periodontal fibers. The main tissue elements of the periodontal ligament are connective tissue fibers.

As the tooth erupts, the periodontal fibers form bundles to support the tooth. The bundles are arranged to withstand the functional stresses of the tooth after it reaches the occlusal plane. These fibers are somewhat elastic and permit a certain amount of tooth movement. The principal fibers are so arranged that they apply a pulling force on both the cementum and the alveolar process when a force is applied to the tooth. The list below identifies the principal fiber groups composing the periodontal ligament. Refer to figure 2-12 as you study these fiber groups.

a. Alveolar crest—extends from the cervical cementum to the crest of the alveolar bone. They help hold the teeth in the socket and oppose lateral forces.

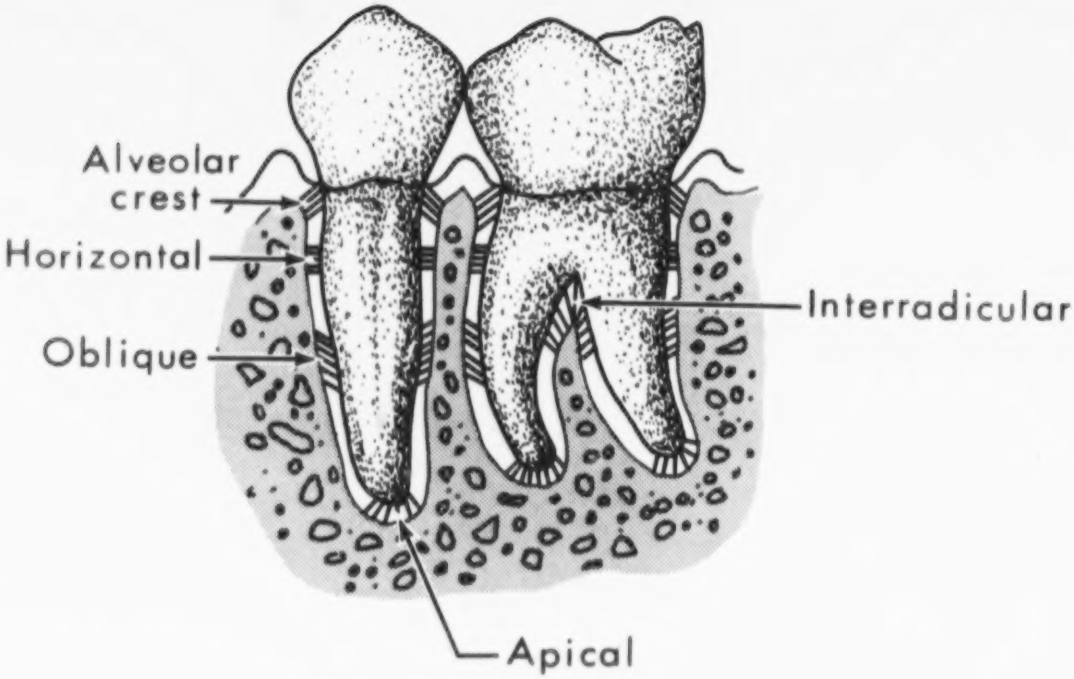


Figure 2-12. Periodontal fibers.

b. Transseptal—extends from the cementum of one tooth over the alveolar crest to the cementum of the adjacent tooth. They provide interproximal gingival support and help hold adjoining teeth together.

c. orizontal—extends from the cementum to the alveolar bone at right angles to the tooth root. They prevent lateral movement of the tooth.

d. Oblique—extends obliquely from the cementum of the apical two-thirds of the root upward to the alveolar bone, creating a suspensory or hammock effect. They anchor and suspend the tooth in the socket and resist occlusal pressures.

e. Apical—extends from the cementum surrounding the apex of the root to the alveolar bone. They prevent tipping and extruding of the tooth.

f. Interradicular—passes from cementum to the interradicular bone system in the multirooted teeth.

Alveolar process. The alveolar process is that bony portion of the maxilla and mandible which supports the teeth. The alveolar process is composed of two parts: the cortical bone and the cancellous bone.

The outer portion of both the lingual and the facial surface of the alveolar processes is covered by the cortical bone. The cortical bone is a dense, compact bone. It covers the alveolar processes and is continuous with the body of the jaws. The cortical bone gives the alveolar process its shape and protects the softer bone and tissues inside.

Cancellous bone is a porous, spongy type of bone; it is often called spongiosa. In composition, cancellous bone is a network of narrow spaces and spicules (spike-shaped bone) called trabeculae (trah-beck-you-lye). Blood and lymph vessels course through this cancellous bone to the periodontal ligament. After a tooth has been removed, this network of vessels supplies the nourishment needed to heal the socket.

The alveolar process undergoes continuous change due to growth, stress, advancing age, and tooth loss. Since the principal function of the alveolar process is to support the teeth, the entire alveolar process undergoes partial atrophy, or decreases in size, when the teeth are lost.

Gingiva. The gingival tissue surrounding the teeth consists of the free gingiva and the attached gingiva. The free gingiva lies relatively close against the crown just above the cervix. That edge of the free gingiva which is toward the occlusal and incisal surfaces of the teeth is called the gingival margin. The V-shaped space reaching from the free gingival margin to the depth where the gingiva attaches to the tooth is called the gingival sulcus or gingival cervix. The triangular fold of tissue that fills the space between adjacent teeth is the interdental papilla (see fig. 2-13). The papilla is separated into facial and lingual peaks, joined by a depression near the contact area. This depression, shown in figure 2-14, is known as the col. It is most commonly found between the posterior teeth and tends to accumulate debris. The interdental papilla is composed of both free and attached gingiva. Refer to figure 2-15. The attached gingiva is that portion covering the alveolar bone. It is mainly a connective tissue, covered by epithelium, which is held snugly against the alveolar cortical plate. The attached gingiva closely follows the outline of the supporting alveolar bone, rising over root eminences and developing into valleys between these eminences. The entire gingiva contains a very rich nerve and blood vessel supply; when

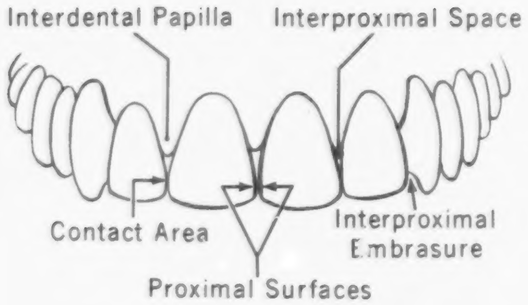


Figure 2–13. Proximal surfaces and contact areas of the teeth.

healthy, this tissue has a stippled appearance. The attached gingiva is connected to its supporting structures by an arrangement of collagen fibers. These fibers are located in what is known as the dentogingival junction. The collagen fiber groups of the gingiva are divided into three groups:

a. Groups I, II, and III gingival fibers—Group I extends outward and upward from the cementum to just beneath the epithelium in the lamina propria (connective tissue). Group II extends outward at right angles from the cementum to the gingiva. Group III extends outward from the cementum and over alveolar crestal bone, bending apically to join fibers arising on the outer aspect of the bone.

b. Transseptal fibers—extend from the cementum of a tooth to the cementum of the adjacent tooth (located only in interproximal areas).

c. Circular fibers—pass circularly around the tooth within the gingiva.

d. Alveologingival fibers—extend from the alveolar crest into the lamina propria.

Exercises (251):

1. What is the general name for those tissues that surround and support the teeth?
2. What is the function of the periodontal fibers?
3. What are the four functions of the periodontal ligament?
4. What is the periodontal fiber group that extends from the cervical cementum to the crest of the alveolar bone?
5. Which periodontal fiber group creates a hammock effect?
6. Which type of bone covers the outer portion of both the lingual and facial surfaces of the alveolar process?
7. What is a cancellous bone?

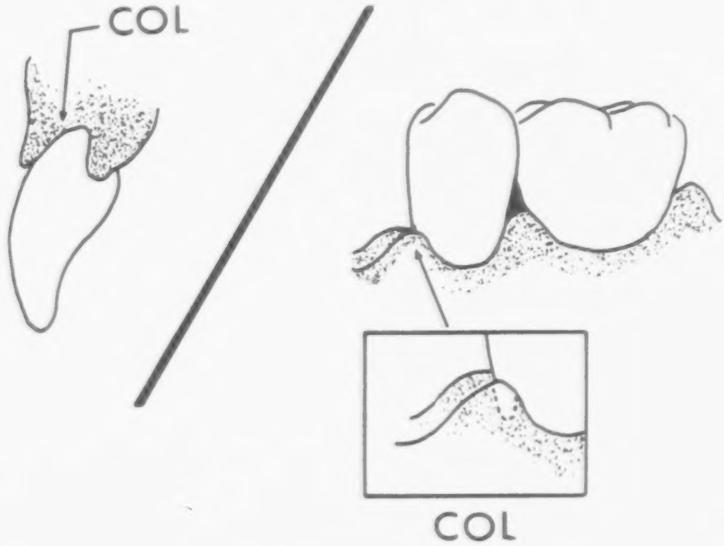


Figure 2–14. The col.

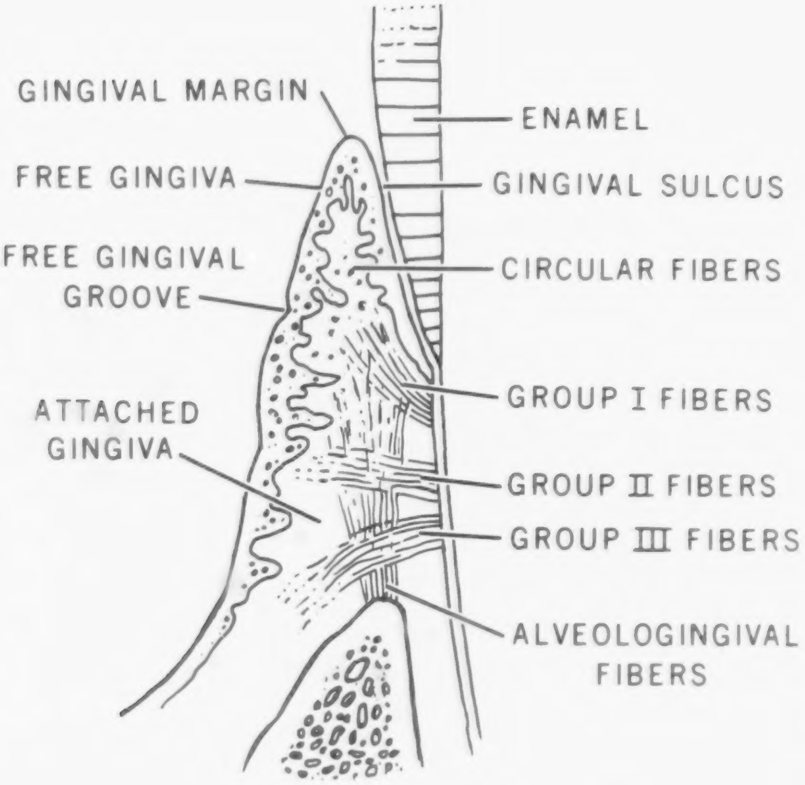


Figure 2-15. Gingiva.

8. What are the two types of gingiva that surround the teeth?

9. Which gingival fibers extend from the alveolar crest into the lamina propria?

2-5. The Life Cycle of a Tooth

A tooth is a living, functional organ with three developmental processes instead of the one or two that usually go into the formation of an organ. The liver grows, which is only one developmental process; bone grows and then calcifies, which comprises two developmental processes; however, before a tooth can become functional it must grow, calcify, and erupt into its functional position. The development of a tooth, as with the development of any organ, is a continual process. Its developmental history has into several periods and stages.

252. Identify the stages of tooth development.

The Growth Period. Dental development begins about the 5th to 6th week of intrauterine (inside the uterus) life. Within a short period, the development of all the primary teeth is initiated. By the 17th week of prenatal (before birth) life, development has begun on the permanent teeth; however, the initiation and growth of the teeth is spread over a period of many years from early prenatal development through the time of the development of the third molars.

The teeth are formed from two of the primary embryonic cell layers: the ectoderm, which has differentiated (increased in complexity) into *oral epithelium;* and the mesoderm, which has differentiated into connective tissue known as mesenchyme. The enamel of the tooth will develop from the oral epithelium, and the remaining structures will develop from the mesenchyme.

Each tooth develops from a tooth bud which consists of three parts:

(1) A dental organ, also known as an enamel organ. It is derived from the oral epithelium and will produce the tooth'ss enamel.

(2) A dental papilla, which is derived from the mesenchyme and will produce the tooth's pulp and dentin.

(3) A dental sac, which also is derived from the mesenchyme and will produce the cementum and the periodontal ligament.

Initation. The beginning of dental development is the formation of a band of thick ectodermal tissue in the region of the future dental arches. It extends along a line that represents the margin of the jaws. This band of thickened ectoderm differentiates into oral epithelium and is called the *dental lamina*.

The dental lamina produces a series of inverted cup-shaped enlargements almost as soon as it is formed. These form the tooth buds. At first these buds appear as solid structures; then they become hollowed out, and in this form they serve as molds to fashion the developing crowns of the teeth. Ten of these buds are normally present in each jaw, at sites corresponding to the location of the future primary teeth.

This initiation, the beginning for each tooth, takes place at a different time for each tooth but follows a definite pattern for each type of tooth. The permanent teeth develop similarly. The dental lamina continues to grow posteriorly to produce tooth buds for the three permanent molars, which will develop distal to the primary teeth on each side of the jaws. The tooth bud for the first permanent molar forms at about the 17th week of fetal life; the tooth buds for the second molars form about 6 months after birth; and those of the third molars form at about 5 years of age.

The succedaneous teeth (permanent teeth that replace the primary teeth) develop from tooth buds in the deep portion of the dental lamina on the lingual side of the primary teeth. The tooth buds for the permanent incisors develop slightly in advance of those for the cuspids. The tooth buds for the first premolars develop in the 8th month of intrauterine life. The portion of the dental lamina that is not utilized in producing the tooth buds normally disintegrates.

Proliferation. To proliferate means to grow and increase in number. Marked proliferative activity continues at the points of initiation. This proliferative growth causes regular changes in the size and portion of the growing tooth.

As cell proliferation continues, unequal growth in different parts of the enamel organ causes it to take a shape somewhat resembling a cap, with the outside directed toward the oral surface. This stage is sometimes referred to as the *cap stage*. Because of the proliferation of cells, the mesenchyme within the cap becomes denser and more cellular and forms the dental papilla, which will form the dentin and the pulp of the tooth.

Histodifferentiation. During histodifferentiation the cells differentiate and become specialized. The epithelial cells become *ameloblasts* (enamel-forming cells). The peripheral cells of the dental papilla differentiate and become *adontoblasts* (dentin-forming forming cells).

Surrounding the deeper side of this structure, which is made up of the combined enamel organ and the dental papilla, the third part of the tooth bud forms. The mesenchyme in this area becomes somewhat what fibrous in appearance. These fibers encircle the deep side of the papilla and the enamel organ to form the *dental sac*. During and after these developments, the dental organ continues to change and assumes a shape resembling a bell. This stage is sometimes referred to as the *bell stage*. As these developments take place the dental lamina, which has thus far connected the dental organ to the oral epithelium, breaks up.

Dentinogenesis imperfecta is, as the name implies, dentin that is imperfectly formed. During the period of histodifferentiation and mineralization, a modification of normal developmental events occurs and the dental tubules are arranged irregularly. The teeth of children exhibiting the condition are soft and often are lost early in life.

Morphodifferentiation. The pattern, or basic form and size, of the future tooth is established by differential growth known as *morpho*differentiation (the prefix morpho refers to shape and form).

The *dentinoenamel and dentinocemental* junctions are established during morphodifferentiation. These junctions are different and characteristic for each type of tooth. The dentinoenamel and dentinocemental junctions act as a blueprint pattern during morphodifferentiation.

In conforming with this pattern, the ameloblasts, odontoblasts, and cementoblasts deposit enamel, dentin, and cementum to give the completed tooth its characteristic form and size.

Disturbances in morphodifferentiation may affect the shape and size of the tooth without impairing the function of the ameloblasts or odontoblasts. New parts may be differentiated, causing supernumerary (extra) cups and roots. Microdontia (abnormally small teeth) or macrodontia (abnormally large teeth) also may result. A peg or malformed tooth, such as Hutchinson's incisor, with enamel and dentin that are normal in structure could result. Hutchinson's incisor is usually associated with congenital syphilis.

Apposition. Apposition refers to the deposition of the matrix for the hard dental structures. This matrix is deposited by the cells along the site outlined by the formative cells at the end of morphodifferentiation. This determines the future dentinoenamel and dentinocemental junctions in accordance with a definite pattern of cellular activity that is common to all types of teeth.

The development of the roots begins after the enamel and dentin formation has reached the future *cementoenamel junction*. This enamel organ plays an important part in root development by forming *Hertwig's epithelial root sheath*. This sheath molds the shape of the roots and initiates dentin formation in the root area.

Appositional growth of enamel and dentin is a layerlike deposition (depositing) of extracellular matrix. It is the fulfillment of the plans outlined at the stages of histodifferentiation and morphodifferentiation. Development is not a simultaneous event throughout the tooth. The first dentin and enamel formation begins at the tips of the cusps of multicuspid teeth or at the uppermost portions of unicuspid teeth.

Appositional growth is characterized by regular and rhythmic deposition of the extracellular material. Periods of activity and periods of rest alternate at definite intervals in its activity and are reflected in the *incremental lines of Retzius*.

In multicuspid teeth, the area at the junction of the cusps is the last part of the enamel to be elaborated. The site of the union of adjacent cusps is arranged in such a manner that a *pit* or fissure may be present and partially separate the adjoining cusps. A fissure is a fault along the developmental groove where two developmental centers join together. A pit results when two developmental grooves cross. The enamel in these areas is particularly thin; and these areas are often inaccessible for cleaning, making them sites where decay frequently begins.

Adverse metabolic or environmental conditions may cause malformation of the enamel, and hypoplastic enamel may result. *Enamel hypoplasia* is a deficient formation of the enamel matrix, caused by injury to the ameloblasts, with pitting or grooving of the enamel at the same levels on all teeth forming at that time. The effect may be acute or chronic. This scarring of the enamel is permanent.

The calcification period. Calcification is the process by which organic tissue, that is, the matrix formed during apposition, becomes hardened by a deposit of calcium or any mineral salts.

The enamel is built layer by layer. Its formation begins at the top of the crown of each tooth and spreads downwardly over its sides. If the tooth has several cusps, a cap of enamel forms over each. These caps *coalesce* (fuse). At a short distance from the ameloblasts, the matrix of the enamel begins to calcify, forming rods. The enamel increases in thickness by the elongation of these enamel rods as the ameloblasts recede outwardly.

By the time the tooth is ready to erupt, the enamel organ has ceased to function and is a much reduced structure. Its last function is the formation of *Nasmyth's* membrane over the surface of the tooth; however, this is quickly destroyed after the tooth erupts.

As the dentin matrix is formed, the odontoblasts recede inwardly, narrowing the pulpal chamber and leaving behind a structure called the *dentinal tuble*. When fully calcified, dentin is not as hard as enamel, for it contains a much larger amount of organic matter. Dentin continues to be formed slowly throughout the life of the tooth, and the pulp cavity becomes reduced in size with age. Injury or disease, such as decay, causes increased activity and there is a deposit of *secondary dentin*.

A thin layer of cementum is deposited over the root before the tooth erupts. Since none of the cementoblasts become embedded, this is a noncellular layer which is designated as *primary cementum*.

Abnormalities of calcification include *hypocalcification*, which is insufficient calcification, and *mottled enamel*. Mottled enamel is opaque. In severe cases it is chalky and crumbles easily, in contrast to normal enamel, which is hard, glossy, and translucent. Mottled enamel may be caused by ingestion of *excessive* amounts of fluorides.

The eruption period. A tooth may successfully pass through the various stages of formation and calcification and yet be unable to perform its normal function if its eruptive processes have been disturbed. Eruption is therefore a very essential phase in the tooth's development.

Eruption is the process through which the forming tooth comes into and tries to maintain occlusion. In the past, the term "erupt" was applied only to the appearance of the teeth in the oral cavity; however, the emergence through the gingiva is merely one incident in the process of eruption.

Eruption of both the primary and the permanent teeth can be divided into prefunctional and functional phases. The *prefunctional* phase of eruption begins with the formation of the root and is completed when the teeth reach the occlusal plane. During the ***functional phase*** the teeth continue to move into the proper relationship to the jaw and to each other as natural wear removes tooth structure. This phase continues throughout the lifetime of the tooth.

Eruption schedule. The primary teeth serve as guides and space maintainers for the developing permanent teeth, and their premature loss can seriously affect the eruption of the permanent dentition. Before the succedaneous teeth can erupt, the primary teeth must be shed naturally or removed. Natural shedding is accomplished by the process of *resorption* of the roots. Resorption in this instance is a gradual and natural disappearance, literally a dissolving of the root structure.

Disruptions in the eruption process can cause impacted, malposed, or ankylosed teeth. A tooth is *impacted* when its eruption into normal occlusion is partially or wholly obstructed by a bone or other teeth. Malposed teeth are those which erupt outside the normal dental alignment. An *ankylosed* tooth is one which becomes fixed to the bony socket instead of being held suspended in place in the periodontal ligament. Ankylosis prevents the continuing eruption of the tooth. (See table 2-4 for approximate eruption times.)

Attrition. Attrition is the amount of wear on the occlusal and interproximal surfaces of the teeth during normal masticatory function. Excessive wear can occur on individual teeth that are out of normal position or exposed to local trauma caused by habits such as biting on hard objects, or the entire dentition may show extreme signs of attrition if exposed to abnormal wear such as bruxism. *Bruxism* may be described as the act of grinding or "gritting" the teeth, especially during sleep.

Erosion. Erosion is the wearing away or loss of tooth structure by chemical process without known bacterial action. Erosion usually begins in the enamel at the neck of the tooth. *Abrasion* is the wearing away of the tooth structure by some form of friction such as brushing with harsh tooth abrasives.

Exercises (252):

1. Match the correct period or stage of tooth development listed in column B with its description located in column A. Each item listed in column B will be used only once.

Column A

____ (1) Is spread over many years, from early prenatal development through the time of the development of the third molars.
____ (2) The formation of a band of thick ectodermal tissue in the region of the future dental arches.
____ (3) Continues at the points of initiation, causes regular changes in the size and portion of a growing tooth.
____ (4) The cells differentiate and become specialized.
____ (5) the pattern or basic form and size of the future tooth is established.

Column B

a. Morphodifferentiation.
b. Apposition.
c. Initiation.
d. Calcification.
e. Histodifferentiation.
f. Attrition.
g. Growth period.
h. Eruption.
i. Proliferation.

Column A *Column B*

____ (6) The deposition of the matrix for the hard dental structures.

____ (7) The process by which organic tissues becomes hardened by a deposit of calcium or any mineral salts within its substance.

____ (8) The process through which the tooth comes into and tries to maintain occlusion.

____ (9) The wearing on the occlusal and interproximal surfaces of the teeth during normal masticatory function.

2-6. Dental Anatomy

As a dental assistant, you should become familiar with the terms generally used in describing the external appearance of the teeth. You will use this knowledge when completing dental rec radiographs (for calculus, b you should realize that the char arrangement of the teeth are fac efficiently perform their three major func speaking, and esthetics. Finally, keep in n this discussion covers the normal conditions, mouth may vary from the norm.

253. Specify whether given statements correctly reflect descriptive terms related to divisions and surfaces of the teeth.

The Teeth. Normally, each person gets two sets of teeth during his or her lifetime. The first, or deciduous set, consists of 20 teeth. The second, or permanent set, usually consists of 32 teeth. With the mouth open, viewers can see that the teeth are arranged in two opposing arches. The teeth in the upper arch are called the maxillary teeth, and those in the lower arch are called mandibular teeth. Each tooth also has five surfaces, and each surface is named accoding to the its direction.

TABLE 2–4

TOOTH ERUPTION SCHEDULES

	Eruption (Months)	Exfoliation (Years)
Mandibular Centrals	6	6
Mandibular Laterals	7	7
Mandibular Cuspids	16	9 1/2
Mandibular First Molars	12	10
Mandibular Second Molars	20	11
Maxillary Centrals	7 1/2	7 1/2
Maxillary Laterals	9	8
Maxillary Cuspids	18	11 1/2
Maxillary First Molars	14	10 1/2
Maxillary Second Molars	24	10 1/2

	(Years)
Mandibular Centrals	6-7
Mandibular Laterals	7-8
Mandibular Cuspids	9-10
Mandibular First Bicuspids	10-12
Mandibular Second Bicuspids	11-12
Mandibular First Molars	6-7
Mandibular Second Molars	11-13
Mandibular Third Molars	17-21
Maxillary Centrals	7-8
Maxillary Laterals	8-9
Maxillary Cuspids	11-12
Maxillary First Bicuspids	10-11
Maxillary Second Bicuspids	10-12
Maxillary First Molars	6-7
Maxillary Second Molars	12-13
Maxillary Third Molars	17-21

The dental arches. The teeth are aligned into two dental arches, the maxillary and the mandibular. Each contains the same number and types of teeth. As the arches function, the movable mandibular arch brings the primary forces of occlusion to bear against the immovable maxillary arch. The arches and the teeth within each arch have adaptations in their structural and occlusal relations. When the teeth touch stabilization and equalization of these forces occur. One adaptation within the arch itself is that the outline of the maxillary arch is somewhat larger than that of the mandibular arch. This creates the normal relationship in which there is horizontal and vertical overlap of the maxillary teeth over the mandibular teeth.

The teeth in each arch are arranged in close mesial and distal contact with neighboring teeth to present an unbroken series of occlusal surfaces; however, the last molar in either arch is in contact only with the tooth mesial to it (*mesial*—toward the midline; *distal*—away from the midline, toward the posterior).

Form, proper positioning, and angulation influence the functioning of each tooth within an arch. Through normal development and proper positioning of all its parts, the dental arch is designed to be an efficient unit for service and stability. The efficiency is assured as long as the normal arrangement is maintained. However, malocclusion, the irregular and abnormal positioning of the teeth, will greatly reduce the functioning, efficiency, and stability of the dentition.

Antagonists. Each tooth in the dental arch has two antagonists or teeth it contacts in the opposing arch—its class counterpart and the tooth proximal (next) to it. The only exceptions to this rule are the mandibular central incisors and the maxillary third molars; they have only one antagonist. The mesial-distal antagonistic relationship of the permanent first molars is considered as the "key of occlusion" in a normal relationship. In class I or ideal occlusion, the mesiobuccal cusp of the permanent maxillary first molar occludes in the buccal groove of the permanent mandibular first molar.

This scheme serves to equalize the forces of impact in occlusion and to distribute the work of the teeth more evenly. Each tooth helps to support the next, yet the loss of one tooth does not necessarily throw out of function another tooth in the opposing arch. Since each tooth has two antagonists, the loss of one still leaves one remaining antagonist which, in most cases, will keep the tooth in occlusal contact with the opposing arch and keep it in its own arch relationship. At the same time, it prevents elongation and displacement through the lack of antagonism.

Quadrants. An imaginary midline divides each arch into mirror halves. The two halves create four sections or quarters that are called quadrants.

There is another descriptive division made in the oral cavity. This division splits the oral cavity into an anterior and a posterior region. Anterior and posterior are the most frequently used references in dentistry. Anterior means toward the front. Thus, the first three teeth on either side of the midline of each normal arch are called anterior teeth. Posterior means toward the rear, so all the teeth behind the anterior teeth are called posteriors. Refer to figure 2-16 and see how the arches are divided into both guadrants and anterior-posterior regions.

Surfaces of the teeth. There is really only one surface on the crown of a tooth, the coronal surface. However, because of the bending over of this surface, other areas appear that face in several directions. These latter areas also are known as surfaces and receive their names from the directions in which they face.

The five surfaces on any one tooth are the same as the five surfaces of another, except for one major difference—that being the name of the working surface of the anterior and posterior teeth. The biting (working) surface of the anterior is called the *incisal* surface, whereas the chewing (working) surface of the posterior teeth is called the *occlusal* surface. The four remaining surfaces of all teeth have common names, whether that tooth is anterior or posterior.

Now let us consider two common surfaces of each tooth, the distal and the mesial surfaces. When you determine the mesial and distal surfaces of a tooth, think of these surfaces as being on a flat plane. The relationship of the teeth to their normal arch shape and a flat plane is shown in figure 2-17. Note the imaginary line which equally divides both the upper and lower arches between the central incisors. This line is called the median line. If we consider the place where the line divides the central incisors as our starting point, the tooth surfaces nearest this point are called the *mesial*, while those which face away from it are known as the *distal* surface. Thus, the mesial and distal surfaces of two adjoining teeth are always adjacent.

The remaining two surfaces common to all teeth are the facial and the lingual. The *facial* surface is toward the lips in the anterior region and toward the cheeks in the posterior region. The tooth surface pointed toward the tongue in both regions is the *lingual* surface.

The mesial and distal surfaces of adjacent teeth are known as *proximal* surfaces, as shown in figure 2-16. The space between the proximal surfaces is called the interproximal space. The point where proximal surfaces of adjacent teeth make contact is at the greatest contour of the adjoining tooth crowns. These points are called contact points. In this way, teeth help to support each other. As age increases, wearing occurs at these contact points due to the movement of the teeth. The result of this wear is an interproximal support through surface contact rather than by point contact. The interproximal wear area widens outward from the contact point both facially and lingually. Part of the interproximal space below the wear point is filled by interdental papilla.

Exercises (253):

Identify each true statement and explain why the others are false.

___ 1. The deciduous set of teeth usually consists of 22 teeth.

___ 2. Each tooth has five surfaces, and each surface is named according to the direction it faces.

___ 3. Since the arrangement of the teeth resembels an arch, the teeth form the maxillary and the mandibular arches.

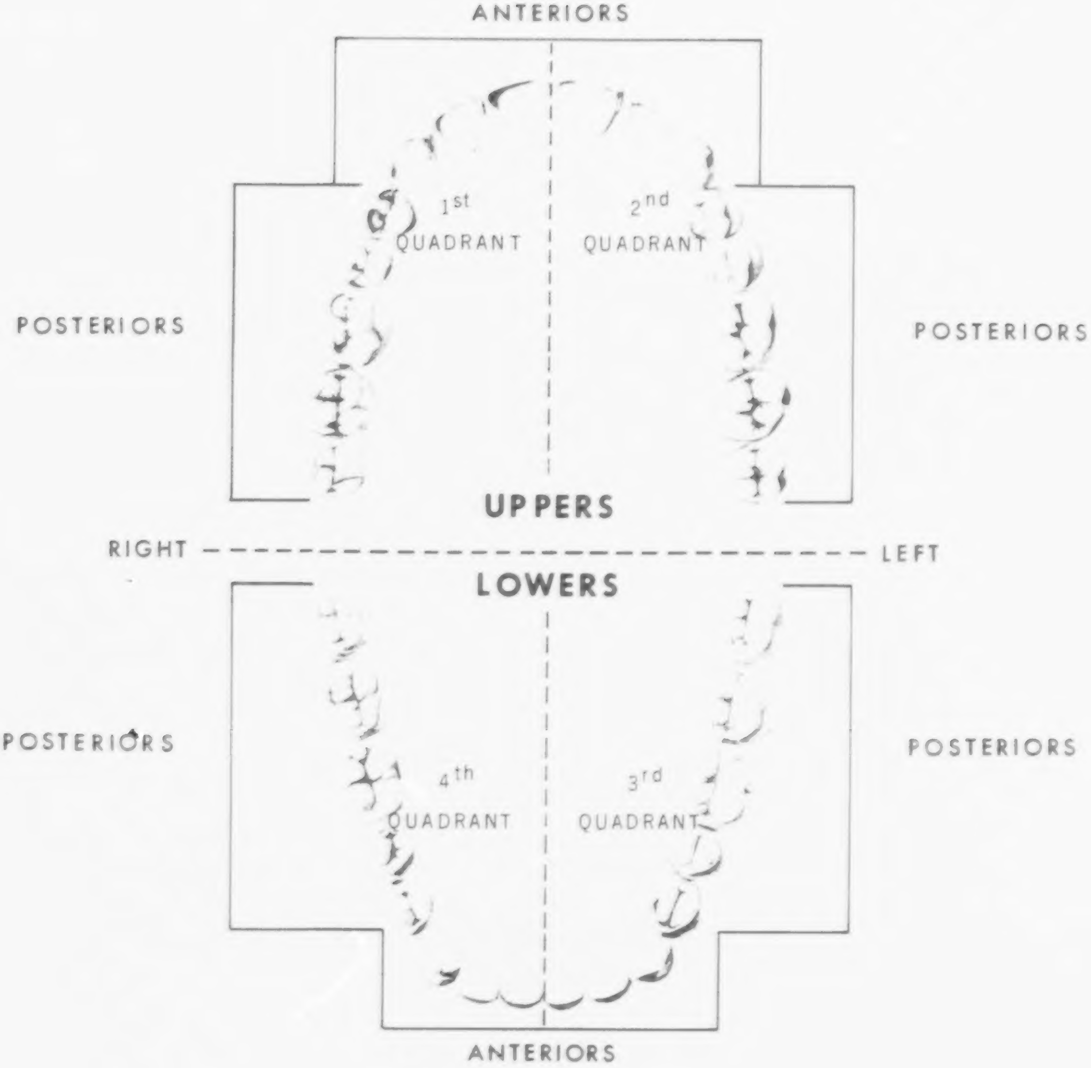

ANTERIORS
1st QUADRANT
2nd QUADRANT
POSTERIORS
POSTERIORS
UPPERS
RIGHT
LEFT
LOWERS
POSTERIORS
POSTERIORS
4th QUADRANT
3rd QUADRANT
ANTERIORS

Figure 2-16. Division of the arches.

____ 4. Each tooth in the dental arch has one antagonist in the opposing arch.
____ 5. The six front teeth of each normal arch of permanent teeth are described as anterior teeth.
____ 6. All the teeth behind the anterior teeth are described as being in the fourth quadrant.
____ 7. The surface on the crown of any tooth can be accurately described as the coronal surface.
____ 8. The biting (working) surface of anterior teeth is called the incisal surface.
____ 9. The chewing surface of a posterior tooth is called its occlusal surface.
____ 10. The mesial and distal surface of two adjoining teeth are never adjacent.
____ 11. In either an anterior or a posterior tooth, the tooth surface toward the tongue is its lingual surface.
____ 12. The mesial and distal surfaces are known as proximal surfaces.

254. Identify the types of deciduous teeth, list their function, structure, and location, and explain the exfoliation process.

The Primary Dentition. The 20 teeth of the primary dentition are often referred to as the deciduous, baby, or milk teeth. As the term "primary" implies, the mouth will shed these teeth to make way for their permanent *successors, which are known as succedaneous* teeth. The primary teeth serve several important functions:

(1) They provide adequate chewing surfaces in relationship to the size of the mouth.

(2) They act as an aid in the articulation of speech.

(3) They serve as guides for developing permanent teeth. This last function is particularly important, for the integrity of the permanent arch depends upon the care given the primary teeth.

All the primary teeth should be in normal alignment and occlusion shortly after the age of 2. The roots should be fully formed by the time the child is 3 years old. Between the ages of 4 and 5, the anterior teeth should begin to separate and usually will show greater separation as time goes on. This process is caused by the growth of the jaws and the approach of the permanent teeth from the lingual side. After normal jaw growth has resulted in considerable separation, the occlusion is made more efficient by the eruption and coming into occlusion with the first permanent molars. These permanent molars appear immediately distal to the primary second molars.

To perform their specialized functions, the primary teeth have specialized characteristics:

a. Their number, size, and pattern are adaptable to the small jaws during the early years of life.

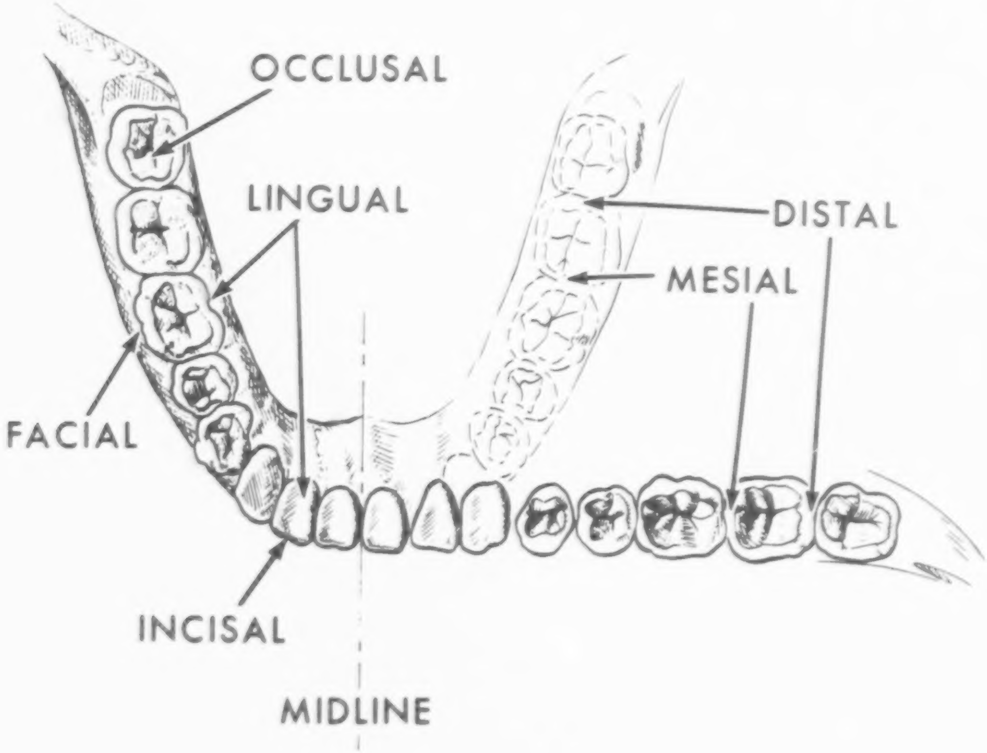


Figure 2-17. Surfaces of the teeth.

b. The size of their roots and therefore the strength of the periodontal ligaments are in accordance with the developmental stage of the masticatory muscles.

c. When they no longer meet the needs of the growing individual, these teeth are lost. They are replaced by the permanent teeth, which are larger and more numerous and which possess a stronger suspensory ligament.

The antagonistic relationship of the primary teeth is the same as in the permanent dentition in that each tooth occludes with two teeth in the opposite arch. The exceptions to the above statement are the mandibular central incisors and the maxillary second molars. In general, the primary teeth are smaller than the permanent teeth. Also, the enamel is thinner and the pulp chamber is relatively large. The crowns are milk-white in color and appear to be short and squat when compared with the permanent teeth. This occurs because in the relative total crown-root length of the tooth, the crown height of the primary tooth is significantly less than that of its permanent counterpart. Also, the primary teeth consistently show a greater mesiodistal width relative to the height of the crown. This too contributes to the squat appearance.

Primary maxillary first molar. This tooth has an occlusal form that varies from that of any other tooth in the permanent dentition. Although there are no premolars in the primary set, in some respects the crown of this primary molar resembles a permanent maxillary premolar. The divisions of the occlusal surface and the root form with its efficient anchorage make it a molar, both in type and function. This tooth has four cusps and three roots.

Primary maxillary second molar. This tooth resembles the first permanent molar in all facets but size. It has four well-developed cusps, one supplemental cusp (the cusp of Carabelli), and three roots.

Primary mandibular first molar. This tooth does not resemble any of the other teeth, primary or permanent. Because it differs so much from all others, it appears strange and primitive; however, it too has four cusps and two roots.

Primary second molar. This tooth resembles the permanent mandibular first molar except in its dimensions. It has five cusps and two roots.

The primary molar roots are long and slender when compared with those of the permanent molars. These roots appear to erupt directly from the crown, for there is no root trunk or root base. In addition, they have a marked bowing or flaring outward and extend beyond the surfaces of the crown. This design allows the development of the permanent premolar bud. The bud occupies the space between the roots, while retaining solid support for the primary molars during active junction.

Exfoliation. The exfoliation, or shedding process, of the primary teeth takes place between the 5th and 12th years. During this *mixed dentition stage*, the child has some permanent and some primary teeth in position. Developing abnormalities often become apparent at this stage. Active orthodontic treatment is not usually undertaken until almost the end of the mixed dentintion stage. However, it is important that the orthodontist for diagnosis and interceptive treatment throughout this period.

The shedding process is caused by the resorption of the roots by *osteoclasts* that have differentiated from themselves the cells of the loose connective tissue. This preparation comes in response to the pressure exerted by the growing and erupting permanent tooth. This process of resorption begins within a year or two of the time the root of the tooth is complete, with the apical foramen established. At that time, resorption begins at the apex and continues in the direction of the crown, and the crown is eventually lost because of lack of support.

At first, pressure in directed against the bone separating the alveolus of the primary tooth and the crypt of its permanent successor. Later, the pressure is directed against the root surface of the primary tooth itself. Because of the position of the permanent tooth, the resorption of the roots of the primary incisors and cuspids starts on the lingual surface in the apical third. The movement of the permanent tooth at this time proceeds in an occlusal and labial direction.

Usually, resorption of the roots of the primary molars begins on the surfaces of the root facing the interradicular septum. This is due to the fact that the bud of the premolars is at first found between the roots of the primary molars. In the later stages, the bud of the permanent tooth is frequently directly apical to the primary tooth. In such cases the resorption of the primary roots proceeds from the apex of the root upward, thus allowing the permanent tooth to erupt later in the position of the primary tooth. Throughout the process, the primary tooth serves as a guide for the developing tooth; its crown serves to preserve the space needed by the succedaneous permanent tooth.

Exercises (254):

1. List three important functions of primary teeth.

2. What causes the anterior teeth to separate between the ages of 4 and 5?

3. How do primary teeth differ from permanent teeth in appearance?

4. Which primary tooth resembles the first permanent molar in everything but size?

5. Which primary tooth does not resemble any of the other teeth, primary or permanent?

6. Briefly explain the exfoliation process.

255. Identify the types of permanent teeth in terms of their function, structure, and location.

The Permanent Dentition. An individual tooth may be identified by its position—for example, maxillary left central incisor. It also may be identified by its anatomical form, since each tooth has its own particular characteristics that set it apart from any other tooth. The full complement of 32 permanent teeth is divided by position, shape, and function into 8 incisors, 4 cuspids, 8 bicuspids, and 12 molars. The positions of the teeth are shown in figure 2-18.

Incisors. The incisors are single-rooted teeth designed for cutting food without the application of heavy forces. The crowns show traces of having developed from four lobes, three facial (labial) and one lingual. In the incisors the lingual lobe is represented by the cingulum, a bridge, which is located near the middle cervical third of the lingual surface. Each labial lobe terminates incisally in a rounded eminence known as a *mamelon*. Mamelons are found on newly erupted incisors; however, they are soon worn down by use.

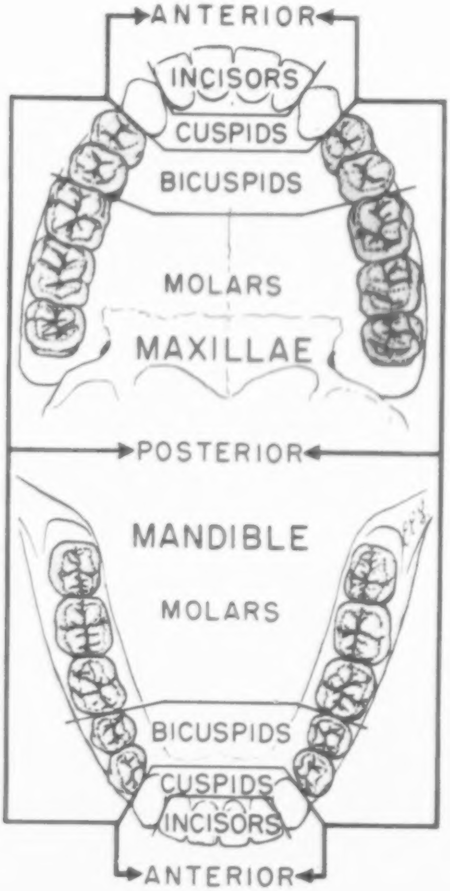


Figure 2–18. Positions of the teeth in the arches.

The *incisal edges* of these teeth are formed at the labioincisal line angle and do not exist until an edge has been created by wear. The incisal edge also is known as the incisal surface or incisal plane.

The incisal edges of maxillary incisors have a lingual inclination (slant), while those of the mandibular incisors have a labial inclination. With this arrangement, the incisal planes of the mandibular and maxillary incisors are parallel with each other, fitting together during cutting action like the blades of a pair of scissors.

Maxillary central incisors. These teeth are the widest mesiodistally of any of the anterior teeth and are the most prominent teeth in the mouth. Although they are larger than the maxillary lateral incisors, these teeth are similar anatomically and supplement each other in function. The maxillary lateral incisors are smaller in all dimensions except root length. These incisors vary in form more than any other tooth in the mouth except the third molar. They frequently are congenitally missing.

Mandibular incisors. These teeth show uniform development, with few instances of malformations or anomalies. They have smaller mesiodistal dimensions than any of the other teeth, and the central mandibular incisor is somewhat smaller than the lateral incisors. This is the reverse of the situation found in the maxilla.

Canine. The four canines are placed at the corners of the mouth, each one being the third tooth from the midline. They are the longest teeth in the mouth. The crowns are usually as long as those of the maxillary central incisors, and the single roots are longer than those of any of the other teeth. The bony ridge over maxillary, the facial portions of the root, is known as the *canine eminence*.

The maxillary and mandibular canines bear a close resemblance in form and function. The middle facial lobe of each cuspid has been highly developed incisally into a strong, well-formed cusp. These cuspid crowns have some characteristics of functional form that resemble the incisor form and some resemble the premolar form. Functionally, they assist both groups.

Because of the shape of their crowns (with their single-pointed cusps), their locations in the mouth, and extra anchorage furnished by the long strongly developed roots, these teeth are well designed for their functions of cutting and tearing. Also, because of the labiolingual thickness of the crown and root and their anchorage in the alveolar process of the jaws, these teeth are perhaps the most stable in the mouth. The crown portions are shaped in a manner that promotes cleanliness.

Bicuspids. The eight bicuspids or premolars, two in each quadrant, are located immediately anterior to the molars. Like the cuspids, they have points and cusps for grasping and tearing; however, they also have a somewhat broader working surface for pulverizing food.

Maxillary bicuspids. These teeth are developed from four lobes, as are the anterior teeth. The primary difference in development is the well-formed lingual cusp, developed from the lingual lobe. The middle facial (buccal) lobe on the bicuspids, corresponding to the middle labial lobe of the cuspids, remains highly developed. The buccal cusp of the first bicuspids is especially long and sharp, assisting the cuspid as a tearing tooth.

The second bicuspids, both maxillary and mandibular, have cusps less sharp than the others, and these *intercusp* (interlock) with opposing teeth when the jaws are brought together. This makes them more efficient as grinding teeth, and they function much like molars.

The maxillary bicuspids crowns and roots are shorter than those of the maxillary cuspids. The root lengths resemble those of the molars; however, the crowns are slightly longer than those of the molars. The maxillary first bicuspids have two cusps (facial and lingual) and two roots (facial and lingual). The maxillary second bicuspids have two cusps (facial and lingual) and one root.

Mandibular first bicuspids. These teeth, like the maxillary bicuspids, are developed from four lobes.

Mandibular second bicuspids. The mandibular second bicuspids are, in most instances, developed from five lobes, three buccal and two lingual. The first bicuspid always is the smallest of the two mandibular bicuspids, whereas the opposite is true in many cases with the maxillary bicuspids. The mandibular first and second bicuspids are single-rooted teeth, with the root of the second bicuspid being larger and longer than that of the first bicuspid.

The mandibular first bicuspid has many characteristics of a small cuspid. It has a large buccal cusp that is long and well formed. It has a small nonfunctioning lingual cusp that in some specimens is not larger than the cingulum found in some maxillary cuspids. The mandibular second bicuspid has three well-formed cusps in most cases (one large buccal cusp and two smaller lingual cusps). This tooth has more of the characteristics of a small molar, because its lingual cusps are well developed and produce a more efficient occlusion with antagonists in the opposite jaw.

Molars. The 12 molars, three in each quadrant, have cusps that are shorter and blunter than those of the other teeth. They produce a broad working surface for the grinding of the more solid masses of food, which require the application of heavy forces. The multiple root structure is designed proportionally to support the larger crown mass.

The *maxillary molars* differ in design from any of the teeth previously described. These teeth assist the mandibular molars in performing the major portion of the work of mastication. By virtue of both their bulk and of their anchorage in the jaws, they are the largest and strongest maxillary teeth. Although the crown on the molars may be somewhat shorter than that on the premolars, their dimensions are greater in every other respect. The root portion may be no longer than that of premolars, but instead of a single or a bifurcated root, the maxillary molars have three full-sized sized roots emanating from a common broad base below the crown.

The *maxillary* first molar is normally the largest tooth in the maxillary arch. It has four well-developed functioning cusps (mesiolingual, distolingual, mesiobuccal, and distobuccal) and one supplemental cusp of little practical use. The fifth, or supplemental, cusp is also called the *cusp* or *tubercle of Carabelli*. This cusp is found lingual to the mesiolingual cusp and often is so poorly developed that it is scarcely distinguishable. There are three roots of generous proportions (mesiobuccal, distobuccal, and lingual). These roots are well separated and well developed. Their placements give this tooth maximum anchorage against occlusal forces that tend to unseat it.

The *maxillary second molar* supplements the first molar in function. Generally speaking, the roots of this tooth are as long as, if not somewhat longer than, those of the first molar. The crown is somewhat shorter than that of the first molar; and there are four cusps (mesiobuccal, mesiolingual, distobuccal and distolingual). A fifth cusp is not is normally present. There are three roots (mesiobuccal, distobuccal and lingual).

The *maxillary third molar* often appears as a developmental anomaly. It differs considerably in size, contour, and relative position from the other teeth. It is seldom as well developed as the maxillary second molar, to which it bears some resemblance. The third molar supplements the second molar in function. Its fundamental design is similar; however, the crown is smaller and the roots are as a rule shorter. The roots are fused together with the resultant anchorage of one tapered root.

The *mandibular molars* help to perform the major portion of the work in the mastication of food. They are the largest and strongest mandibular teeth because of both their bulk and their anchorage in the mandible. They resemble each other in form, although comparison of one with another shows variations. They vary in the number of cusps, in size, in occlusal design, and in the relative length and position of the roots.

Each mandibular molar has two roots, one mesial and one distal. The third molars and some second molars may show a fusion of these roots. The root portions are not as long as those of some of the other mandibular teeth; however, the combined measurements of the multiple roots, with their broad, bifurcated root trunks, result in superior anchorage.

The *mandibular first molar* normally is the largest tooth in the mandibular arch. It has five well-developed cusps (mesiobuccal, mesiolingual, distobuccal, distolingual, and distal) and two well-developed roots (mesial and distal) that are very broad buccolingually. These roots are widely separated at the apices.

The *mandibular second molar* supplements the first molar in function. Its anatomy differs in some details, for normally the second molar is smaller than the first molar by a fraction of a millimeter in all directions. The crown has four well-developed cusps (mesiolingual, mesiobuccal, distobuccal, and distolingual). These roots are broad buccolingually, but they are not as broad as those of the first molar, nor are they as widely separated.

The *mandibular third molar* differs considerably in different individuals and presents many anomalies both in form and in position. It supplements the second molar in function, although it is seldom as well developed. The average mandibular third molar shows irregular development of the crown portion, with undersized roots that are more or less malformed. Generally speaking, its design conforms to the general plan of all mandibular molars, conforming closely to that of the second mandibular molar in the number of cusps and occlusal design.

Exercises (255):

1. What is a mamelon?

2. What is the difference in inclination of the incisal plan between the maxillary and mandibular incisors?

3. What is the function of the cuspids?

4. How do the cusps of the maxillary first bicuspids differ from those of the second bicuspids?

5. Match the descriptive statements in column B with the appropriate tooth column A. from the appropriate statement in the space provided.

Column A

____ (1) Maxillary first molars.
____ (2) Mandibular first molars.
____ (3) Mandibular second molars.
____ (4) Maxillary third molars.
____ (5) Mandibular third molars.

Column B

a. The crown has four well-developed cusps.
b. Normally is the largest tooth in the mandible.
c. Sometimes have a fifth cusp on the lingual aspect of their mesiolingual cusp.
d. Undersized roots which are more or less malformed.
e. Roots are fused together with the resultant anchorage of one tapered root.

Oral Pathology

PATHOLOGY is the study of any abnormal physical condition. Oral pathology is the study of abnormalities of the oral cavity. This chapter is intended to acquaint you with many of the common oral abnormalities. Since you may perform many procedures independently of the dental officer; e.g., prophyloxis), it is important that you recognize conditions that could be highly infectious or that could contraindicate oral prophylaxis. If you recognize any such condition, call it to the attention of the dental officer. If a condition is discovered during its earlier stage, treatment will usually be easier and quicker. While the dental officer treats most abnormalities, there are many instances where you may treat or assist in the treatment of oral disorders. One of the most important treatments you may perform is removing deposits such as dental plaque and calculus. As you read the following text on common pathological conditions, refer to foldout 6 in the supplementary materials, To Volume 4. While reading the text describing a condition, locate its corresponding picture in the foldout.

3-1. Dental Plaque, Calculus, and Stains

Before you can educate a patient about proper oral hygiene, you must have a thorough understanding of the "careless brusher's" two enemies—dental plaque and calculus. Plaque and the resulting calculus must be controlled every day by each patient if he or she is to have good oral health. While stains are seldom harmful to the patient (except for cosmetic reasons), you also should know about the various types of stains.

256. Specify the role of plaque in oral disease by citing its characteristics, composition, weight, signs, the bacteria it contains, and the diseases these bacteria cause.

Dental Plaque. Dental plaque is a destructive and debilitative enemy of the oral structures. Plaque may be likened to a biological warfare agent, since it is an invisible enemy that often causes oral damage before the patient is aware of its presence. Since one of your duties as a dental assistant is to educate the patient toward good oral hygiene, the removal of plaque must be one of your prime topics. This is a difficult task, since it is impossible for patients to see the plaque as they look in the bathroom mirror and brush their teeth. You must convince the patient of its presence and that once plaque forms, it cannot be easily removed with a toothbrush alone. Proper oral hygiene can prevent the plaque from reforming and organizing. You also must know a great deal about plaque before you can educate the patient.

Composition. The patient must understand the composition of plaque in order to remove it. It is a gelatinous, sticky substance, composed mostly of water and approximately 20 percent bacteria. It also contains mucin (mu-sin), a by-product of saliva, which gives stickiness to the substance, and desquamated (des'-kwah-may-ted meaning sloughed off) epithelial cells that have sloughed off the gums and cheeks and have combined with the mucin and water. This gives the plaque "body." There are also some leukocytes (white blood cells) and red blood cells. It takes only a 24-hour accumulation of these materials to form plaque, which becomes increasingly difficult to remove as time progresses. Because of its nature and composition, plaque is sometimes called zooglea gel (living glue) or microcosm (small living world). Plaque, because of its composition, is not soluble in water, even if the water is running, rinsing, or spraying.

Because plaque is a clear, colorless substance, it is invisible to the person infected with it unless they have used a disclosing agent. Even then, the disclosing agent material may be washed away or lose its color while the plaque remains on the teeth. After cleaning a patient's teeth, you may find it necessary to recolor them to see if you have removed all the plaque. Not only does its composition make it difficult to remove, but it is located in crevices in and between the teeth where it is difficult to clean. Stress to your patient that plaque is not materia alba (the yellow-white cheesy accumulation of predominantly desquamated epithelial cells) nor is it food debris. Both of these can be washed away. Actually, except for those bits of food that are trapped, food particles create little problem. In less than 20 minutes after a meal, the normal flow of saliva and the muscle action of the tongue, lips, and cheeks eliminate any food particles that have clung temporarily to the teeth. However, if possible, brushing after each meal is a good habit; brushing rids one's mouth of any trapped food and it acids, and helps keep plaque from forming.

When you have thoroughly removed the plaque from a patient's mouth, tell him or her that it can form again in only 24 hours. Most patients have an excuse for not brushing after each meal, but anyone should find time to carefully clean the mouth at least once a day. Tell your patients if they will conscientiously do this—they *can* avoid a buildup of plaque. Details on how to thoroughly clean the teeth and gums are discussed in Volume 4.

The role of plaque in oral disease. Plaque is most prominent in pits and fissures and between teeth where cleaning is least likely to be adequate. Plaque contains approximately 250 million organisms per milligram of wet weight. A periodontally involved tooth with a 4- or 5-millimeter pocket (2 day's formation of plaque) has about 100 milligrams wet weight of plaque. A high count of streptococci is contained among these microorganisms. These are acid-producing bacteria. These acids may attack the tooth and decalcify the mineral out of the enamel. At first this decalcification manifests itself as a white, chalky spot on the tooth. The degree of acidity increases each time a person eats carbohydrated food, because more acid is formed by the bacteria that are active in the plaque.

This quick surge of acidity lasts for approximately 3 hours. The more dense areas of plaque hold acid longer than less dense areas. Think how often most people eat "snacks," most of which are carbohydrate. After the acids have caused the demineralization of tooth structure, a carious lesion results. Thus, bacterial plaque causes caries—especially interproximal decay between the teeth and at the gum line. Gingival and periodontal diseases also begin in the area of heavy plaque deposits. This fact has led recent investigators to coin the phrase "bacterial plaque infections" as the cause of dental disease.

Micro-organisms overlying and enmeshed in the plaque initiate inflammation by toxins, enzymes, and the byproducts of micro-organisms. Inflammation causes edema (swelling), hyperemia, loss of gingival tone, and disruption of gingival fibers. Debris collects in the gingival pockets, then the exudate from ulcerated cervicular epithelium mineralizes the plaque, and subgingival calculus is formed. Therefore, plaque infection is essential in the inception and progress of gingival-perio diseases.

Since you know that plaque infection causes diseases, you should make every attempt to educate your patient about it. You can determine how long plaque has been in the mouth by identifying the type of bacteria contained in it. There are four types that you can readily identify. During the first 24 hours of plaque formation, the bacterial makeup of plaque is of the coccal and bacillary short rod forms. Both of these types produce acid. From the 2nd to the 5th day of plaque formation, filamentous (branching) bacteria begin to form. Lactobacilli are three times as predominant in plaque as in saliva. As the plaque ages, the filamentous forms increase rapidly. Vibrios and spirochetes predominate in old organized plaque. They are anaerobic and can be obtained from the bottom of the sulci; with all their activity they make the most impressive slides.

Exercises (256):

1. How may plaque be likened to a biological warfare agent?

2. What is plaque composed of?

3. How does streptococci bacteria found in plaque affect tooth enamel?

4. In what form does decalcification first appear on the tooth?

5. What diseases originate in an area of heavy plaque deposits?

6. What can you determine when you identify the type of bacteria found in plaque?

7. What type of bacteria is present during the first 24 hours of plaque formation?

8. Which bacteria predominates in old organized plaque?

257. Distinguish between the two types of calculus according to their positions in the mouth, colors, and consistencies; and also state the composition and manner of formation of calculus.

Calculus. Much research concerning calculus is now in progress. Some of the information that we have today may be modified in the near future. This is the usual "sign of progress". Simply stated, dental calculus is calcified or calcifing bacterial plaque. Several years ago, this substance was called tartar. This adherent, calcified mass is classified according to its location within the mouth.

Supragingival calculus. This is formed above the margin of the gingiva. Its color is cream or yellow unless it has been darkened by coffee, tea, tobacco, or other liquids that add color. Calculus can be found either on a single tooth or in a generalized area. It can completely fill an interproximal space between two teeth. Calculus appears most frequently in salivary duct areas where cleaning has been inadequate. Since supragingival calculus is above the margin, it is visible on the tooth. It is claylike or bricklike in consistency and becomes extremely hard as it gets older. You can determine its consistency by using an instrument or feeling a piece that you have broken loose. It is a good practice to let the patient look at a piece of calculus from his or her mouth, feel it, and break it in his or her fingers. This could help convince some uninformed patients that the hard substance is not a part of their teeth.

Subgingival calculus. This is formed below the crest of the gingival margin. You may have to search for it with instruments such as an explorer, probe, and scaler. Your fingertips must become your eyes to find subgingival calculus. The color of subgingival calculus is dark brown, black, or dark green. The color is caused from staining by blood pigments. The consistency is harder than supragingival calculus. Subgingival calculus has flintlike hardness. It is flat and more firmly attached.

Composition. The composition of calculus is approximately 6 to 15 percent organic (living) substances, 65 percent inorganic substances, and 6 to 20 percent water. The minerals (inorganic substance) found in calculus are calcium, carbonates, phosphates, sodium, trace minerals, and other salts—the same type of substances found in bone and teeth. The inorganic materials are the same in both types of calculus. The major portion of the organic matter has the same composition as plaque containing bacteria. With the exception of water, the organic material is the same in both types of calculus.

Formation. For calculus to form, the plaque must be at least 3 or 4 days old. However, calculus can form in as little as 2 days or take as long as 14 days, depending upon the location of the plaque found. Plaque close to salivary ducts (which is thought to produce calcifying minerals) can calcify in a few days; plaque found deep in periodontal pockets (which is not exposed to heavy mineral concentrations) may take up to 14 days to calcify. As the plaque becomes thicker and older, it begins to calcify and becomes calculus. Calcification begins in the layers of plaque next to the tooth. Since plaque continues to accumulate on the surface, calculus (unless recently brushed) has soft plaque on the outside. The source of the minerals of which calculus is formed is thought to be saliva. Several theories (none universally accepted) help to explain the mechanisms by which calculus forms. These theories are usually divided into physiochemical,, bacteriological and enzymatic.

The physiochemical theory is based on the precipitation of minerals in the saliva. The bacteriological theory is based on the precipitation of minerals into an organic matrix provided by bacteria. The enzymatic theory is that enzymes (either those in the saliva or those produced by bacteria) may cause precipitation of minerals in the saliva. It is generally accepted that regardless of the mechanism by which calculus forms, an organic matrix must be available before calculus can form—and this is provided by bacterial plaque on the tooth.

You must be concerned with children's primary and secondary cuticles. The primary cuticle is sometimes called the Nasmyth's membrane. When the tooth erupts through the epithelium, the crown has a covering which is a byproduct of the tooth follicle. This remains on you area until the tooth is polish the tooth with a rubber cup, which destroys it. If the child does not visit a dentist for this polishing, chewing and brushing eventually will wear away part of this membrane—except in protected areas (interproximal areas). Secondary cuticle called the pellicle (made of glycoproteins and lipids) is a substance that sometimes forms on the tooth. Plaque then attaches to this secondary cuticle and, if not removed, forms calculus.

Exercises (257):

1. Which type of calculus is formed above the margin of the gingiva?

2. What is the normal color of supragingival calculus when it is free of stains?

3. What is the consistency of supragingival calculus?

4. How does the subgingival calculus achieve its dark brown or black color?

5. What percent of calculus is organic substance?

6. Name the inorganic substances found in calculus.

7. How old must plaque be for calculus to form?

8. Where does calcification begin?

9. What is the physiochemical theory based on?

258. Distinguish between the three types of stain as to ease or difficulty in removal, cause, and location; and list the colors of the stain caused by chromogenic bacteria.

Stains. Stains are not as important as plaque and calculus, because stains do not cause disease. However, since stains are important to the patient for cosmetic reasons, you need to know about them. There is a difference between various dental stains. They are classified as "intrinsic" "extrinsic," and "exogenous" stains.

Intrinsic stains. You cannot to help the patient with these stains, since they are "built into" the tooth at the time of formation. The most common cause of intrinsic stains is ingestion of certain substances by the patient. The mottled-brown stain is usually the result of a high concentration of fluoride in the drinking water during the tooth-formation in childhood. Ingestion of tetracycline during tooth formation can cause intrinsic stains ranging from yellow to orange and brown. Penicillin does not cause intrinsic stains. Some intrinsic stains still present in the teeth of adults are the result of the long-time use of silver nitrate by the dentist or from metallic medical compounds prescribed by physicians.

Extrinsic stains. These develop on the outside surfaces of the tooth. These stains are removable during regular oral prophylaxis. The cause of the stains may be coffee, tea, tobacco, and some foods; or they may be caused by chromogenic (color-producing) bacteria. The latter usually causes orange, green, gray, or brown stains.

Exogenous stains. These are extrinsic stains that become intrinsic stains. The change occurs when defects in the enamel surface traps stains. Once they become intrinsic they are not removable. The cause of exogenous stains is the same as that of extrinsic stains. Intrinsic, extrinsic, and exogenous stains *do not* cause inflammation of the gingiva. Dental plaque and calculus *do* cause inflammation.

Exercises (258):

1. What types of stains are not removable?

2. What usually causes the mottled-brown stain found in some teeth?

3. Where do extrinsic stains develop?

4. What four colors of stain are usually produced by chromogenic bacteria?

5. What are exogenous stains?

3-2. Inflammation

Inflammation is the sum of the reactions of the body to injury, either physical or caused by the invasion of a pathogenic organism. Inflammation is an active process. Before an injury will invoke an inflammatory reaction, necrosis (death) of at least some cells must occur. The purpose of inflammation is to limit the extent and severity of injury. This is accomplished by limiting the spread of the injurious agent, neutralizing its effects, or both. It is true that infection is often accompanied by inflammation, but it is possible to have inflammation without infection.

259. Identify the five characteristics of inflammation.

Characteristics of Inflammation. There are five cardinal or classical characteristics of inflammation: rubor (redness), calor (heat), tumor (swelling), dolor (pain), and functio laeso (loss of function). Any or all of these characteristics may be present in inflammation. This means that every time the body is irritated, steps are taken to combat the intruder. Following is an explanation of each characteristic.

Rubor. *Redness* caused by increasing the blood supply to the area of irritation—a vascular and cellular response. Following a short period of vasoconstriction due to direct irritation of the local arterioles, a vasodilation develops due to relaxation of the arterioles. As the vessels dilate, the rate of blood flow is increased. If many leukocytes or much fibrin is present, the tissue may turn yellow or gray.

Calor. *Heat*, a vascular response, also is caused by increased blood supply, along with an elevated body temperature in an effort to stimulate a rapid defense. The increased flow of blood raises the temperature of the inflammed area of the skin. In the center of the area of severe inflammation of the skin, stasis (a cessation of flow) blood may cause cooling or a purplish discoloration.

Tumor. *Swelling* is caused by to accumulated fluids and engorged blood vessels—a humoral and cellular response. The breakdown of tissue and blood cells alters, the fluid makeup of the tissue because of a change in the fluid's chemical balance. The humoral response produces swelling or edema by the pooling of fluid in the area of inflammation.

Dolor. *Pain* warns us that something is wrong. The stretching of the tissues as a result of the vascular and humoral responses and the local accumulation of acid metabolites and potassium irritate sensory nerves and cause local pain.

Functio laeso. Loss of function or altered function is caused by damaged or injured tissue plus swelling. This dysfunction results from the injury to cells, swelling and stiffening of the part, blockage of hollow passages such as bronchi or bile ducts by exudate (pus), and pain if the part is under voluntary control.

Exercises (259):

In items 1 through 5, briefly list each of the characteristics of inflammation.

a. Rubor.

b. Calor.

c. Tumor.

d. Dolor.

e. Functio Laeso.

260. Identify the body's responses to inflammation and, list the two phases of gingival reaction to inflammation.

Responses. Responses can be matched to the characteristics mentioned previously. The sign of pain is a nerve response; the sign of heat is a vascular response; the sign of swelling results from the cellular and humoral responses; and the sign of redness results from vascular and cellular responses.

Vascular response. Whatever the cause of irritation or injury, the result will be a dilation of the capillaries. They enlarge to bring more blood to the area of injury; this pooling of blood in an area will cause the tissue to appear red in color. As a result of excess blood in an area, heat is given off and some swelling will occur.

Cellular response. Neutrophils (new'-truh-fils) are highly motile, phagocytic (antimicrobial) leukocytes. They are formed in the red bone marrow and then released into the blood where they constitute about 60 percent of the white blood cells. Neutrophils are the predominant reacting cell in inflammation. In many cases of inflammation, the white blood cell count rises because of an increase of neutrophils, both in absolute numbers and in proportion to the other leukocytes. In the area of inflammation, the neutrophils leave the blood vessel and invade the tissues. Their main function, is to phagocytize. This is the enveloping, ingestion, and digesting of bacteria and other small foreign particles. Such ingested bacteria are usually but not always killed either by the neutrophil or by a mechanism that is largely unknown. It is known that disintegrating neutrophils release antibacterial substances. Also produced is a proteolytic enzyme that is active at a neutral or weakly alkaline pH. Its purpose apparently is to dissolve ingested cell debris and fibrin in areas of inflammation. If a large number of neutrophils are present in a small area, this enzyme is released from dying neutrophils and is largely responsible for the liquefaction of tissue that occurs when exudate (pus) is formed.

Humoral response. The humoral (hume'-or-al) response to inflammation is a fluid response from the affected tissue and engorged blood vessels. Swelling or edema is present in the area of inflammation as a result of the pooling of fluids produced when blood cells and tissue cells break down.

Nerve response. As a result of the humoral response, pressure and substances released during cellular breakdown irritate sensory nerves. The pain is a warning mechanism that lets you know something is wrong.

Gingival response to inflammation. The gingiva reacts to inflammation in two phases: the destructive phase, which is characterized by edema or swelling; and the repair phase, which is characterized by a fibrous growth (hyperplasia) at the site of the irritation. The edema is a result of a change in the osmotic balance near the site of injury and is the result of humoral and vascular responses to the inflammation. This destructive or breakdown phase also may involve necrosis of the tissue. This tends to reduce the amount of tissue so that it recedes. The repair phase involves a hyperplastic enlargement or proliferation of connective tissue that gives the tissue a firm, leathery, fibrous consistency. This fibrous tissue cannot shrink or be reduced by elimination of edema, since fluids in these tissues are normal.

The destructive and repair phases appear to happen at the same time. But in order for a periodontal condition such as gingivitis to occur, the destruction must exceed the repair. The extent to which destruction predominates over repair may vary within a local area. You have read that the gingival irritants can cause the destructive phase of inflammation to proceed on the side of the gingiva next to the tooth while the repair phase is in process on the outer surface of the gingiva. This means that hemorrhage (bleeding) may occur in the sulcus while at the same time the visible surface of the gingiva might be fibrous and firm in appearance.

When inflammation is present, the objective of periodontal treatment is to resolve inflammation, eliminate pockets, and restore normal tissue contours. It may be necessary to reduce the fibrous tissues by periodontal surgery, since these tissues do not shrink and do not respond to scaling. Remember that fibrous tissue increases as long as the irritant is present. If you see the patient in time, you may save him or her much discomfort and possibly avoid surgery by completely removing the irritant that is causing the inflammation.

Exercises (260):

1. Match each sign or symptom of inflammation in column A with the bodily response with which it is associated in column B. Column B items may be used more than once.

Column A	*Column B*
____ (1) Pain.	a. Cellular.
____ (2) Heat.	b. Vascular.
____ (3) Swelling.	c. Humoral.
____ (4) Redness.	d. Nerve.

2. How is the destructive phase characterized?

3. How is the repair phase characterized?

3-3. Caries, Pulpitis, Abscesses, Pericoronites, Cysts, and Granulomas

Sergeant Smith bit into a candy bar and felt a pain in his tooth. The pain was mild and short. Later he drank cold water and felt the pain again. This was the first time the tooth had bothered him. Most likely his pain was caused by dental caries—the most common pathology of the teeth. If dental caries is not treated, it may advance toward the dental pulp, causing inflammation. This condition is called pulpitis. With pulpitis, the severity of the pain is only partially related to the severity of the inflammatory response. Other contributing factors include whether drainage has been established and the patient's previous experiences, including emotions and other traits. Untreated pulpitis may result in the death of the pulp. A periapical abscess then may form as the pulp dies. The abscess could advance to any of a number of severe oral or physical conditions. Our discussion of the stages of pathology of the teeth begins where the pathology usually begins, with dental caries.

261. Identify dental caries by cause, progress of the disease, signs and symptoms, repair, and control.

Dental Caries. *Caries* is defined as "the local decalcification and disintegration of the enamel and dentin of the teeth." The word comes from the Latin word for rottenness. Whether the patient has one or many such conditions, use the term "caries." Caries is said to be the most prevalent chronic disease in humans. The possibility of caries begins with the eruption of deciduous teeth and continues through life, having certain peak periods. It begins when bacterial byproducts start a gradual dissolution (decomposing) of tooth structure. Interestingly, caries usually occurs on tooth structures that are exposed to oral fluids, however, caries can start subgingivally on either the enamel or root surfaces.

Etiology. As was mentioned, the etiology, or cause, of dental caries is bacteria. Normally, these bacteria are present in the mouth of every individual. All dental caries begin with a plaque deposit on the tooth surfaces that become laden with bacteria. As you recall, dental plaque is a filmlike covering that is almost impossible to see. The plaque is firmly attached to the tooth surface and is composed of water, mucin, tissue cells, and different types of bacteria. If we paint teeth with a dye, such as disclosing solution, the plaque will become colored by the dye and also easily visible. Any area of the tooth surface that is clean and not covered with plaque will not retain the dye color. Tooth decay most commonly occurs in the pits, fissures, grooves, interproximal and gingival areas—those locations where bacterial plaques are found most readily since they are not easily cleaned. Both neglect and lack of oral hygiene contribute to the process of dental caries; so does a diet high in carbohydrates and sugar. No age group is entirely free from the disease, but caries activity is highest up to about 28 to 30 years of age. Basically, there are two theories as to the process of dental caries.

The first is the *acidogenic theory*. This theory states that dental caries is the result of the combined action of acids and bacteria. Carbohydrates and refined sugars are ingested as food by the bacteria *Lactobacillus, acidophilus*, and *Streptococci* to produce lactic acid. Lactic acid first dissolves the inorganic material of the enamel and dentin, permitting the bacteria and their products to dissolve the remaining organic material of the tooth substance.

The second is the proteolytic theory. This theory explains the process of dental caries in the following manner: Bacteria first penetrate small fissures of the enamel. The bacteria in the plaque can produce proteolytic enzymes and then are able to destroy the matrix of cementing media of the enamel and also decalcify the tooth. The mechanism of caries development can be summarized as follows: Enamel caries is primarily a process of decalcification (acidogenic theory), while caries of the dentin and cementum consists of both decalcification and proteolysis (proteolytic theory). The important point to remember is that neglect allows the plaque to form. Fundamentally, in both of these theories, it is plaque that supplies the bacteria needed to cause dental caries.

Signs and symptoms. A sign of a disease is an objective manifestation. The examiner can positively determine a sign; swelling is an example. A symptom of a disease is a subjective manifestation. Only the patient can positively identify a symptom; pain is an example. The signs and symptoms of dental caries are quite specific. Often, the very early signs of dental caries can be detected by a thorough examination, including radiographs of a patient's teeth. The appearance of a carious lesion depends upon the rapidity of the process as well as upon other influencing factors.

In some instances you will find indications of small areas of decalcification of the enamel. Sometimes even after dental caries has begun in the enamel, it stops for unknown reasons. However, the process of dental caries usually continues through the enamel toward the dentin. As the carious process continues, you can see a discoloration of the tooth structure, an increase in the translucency of the tooth structure, and the formation of a cavity. The color of the caries varies from light yellow to dark brown or black.

In caries of the dentin, either a leathery substance or a cheesy mass is formed as the result of decalcification. Both varieties can be scooped out with an excavator. However, a physical change may take place along the pupal wall. This is brought about by the decay process. A hardened layer called secondary dentin may be laid down within the pupal chamber adjacent to the decay. This secondary dentin acts as a protective lining or insulator for the pulp tissue.

Quite often, dental caries presents a combination of signs and symptoms that must be evaluated in order to arrive at a correct diagnosis. Generally, the tooth first becomes sensitive to cold foods and liquids and then to foods and liquids containing high concentrations of sugar. Pain also may occur as a result of local irritations from food particles that have become trapped in the cavity between the teeth and thereby exert pressure upon the interdental papilla. These are the symptoms of what is normally termed "simple tooth decay." The signs of simple tooth decay are discoloration, increased translucency, a break in the surface continuity of the enamel, and inflammation of the interdental papilla. If no treatment is given for this condition, the carious lesion continues to get larger which in turn creates additional complicating factors.

Dental caries control. Since dental caries is a disease of a tissue that cannot regenerate or repair itself, the lesion is progressive. Occasionally, it may be selflimiting—a condition known as arrested caries—but the destroyed area is never selfrepaired. Repair can only be accomplished by restorative dentistry. In addition to restoring carious teeth, there are some other methods that can be used to control the incidence of dental caries.

The higher the lactobacillus and streptococci count, the greater the number of carious teeth. While this statement has been confirmed, no one has yet placed these organisms on a tooth and produced decay. There is a correlation between the lactobacillus and streptococci count and the amount of carbohydrates consumed by an individual. If you decrease the carbohydrate intake, you will also decrease the bacterial count, thereby reducing caries incidence. A proper diet is necessary to insure adequate intake of vitamins and minerals. Correct intake of these substances during tooth development is especially important. After the teeth have developed, diets with controlled amounts of carbohydrates are more important as far as preservation of the tooth structure is concerned.

The roughage in a diet also helps to control caries. The cleansing effect of raw vegetables and some fruits helps to remove some food particles from the teeth. Although this effect offers only slight help, it is better than no cleaning at all. An added benefit of these foods is their low unrefined sugar content. You can see, then, that diet plays a role in the control of caries.

Fluorides also are used in the control of caries. Fluorides, taken as a dietary supplement or in drinking water during the formation of the teeth, lessen dental caries. This occurs because fluoride is incorporated into the enamel as it is formed. Enamel that contains slightly more than the average amount of fluoride seems to inhibit the formation of caries. When taken internally fluorides are effective only while the teeth are forming. Thus, a different method of application must be used after they have formed. In this instance November 1981 report by the U.S. Preventive Dental Office recommended an 8-percent solution as the best choice for topical application. Other methods employed in the application of fluorides are fluoridated toothpastes, mouthwashes, and stannous fluoride prophylaxis paste. All of these measures have limitations, but they should be taken on the premise that they are definitely not harmful and are probably beneficial.

Exercises (261):

1. What is the cause of dental caries?
2. What is the role of dental plaque in tooth decay?
3. Which theory of tooth decay involves the dissolving of tooth structures by lactic acid?
4. What supplies the bacteria needed to cause tooth decay, according to both theories of dental caries?
5. What is arrested caries?
6. How does caries of the dentin appear?
7. What is the purpose of the secondary dentin that is the result of the cellular stimulation caused by caries?
8. What are generally the first symptoms of tooth decay?
9. What is the only way dental caries can be repaired?
10. How does the reduction of carbohydrates consumed by an individual affect caries incidence?
11. How is roughage in a proper diet instrumental in the control of caries?
12. When are fluorides that are taken internally effective in the control of caries?

262. Define pulpitis, distinguish between the two types and cite its signs, symptoms, and treatment.

Pulpitis. Pulp is exposed and pulpitis results when dental caries progress through the dentin. Pulpitis also may result from thermal, toxic, and traumatic injuries of the pulp and/or its chamber. The term "pulpitis" simply means an inflammation of the pulpal tissue. Two types of pulp inflammation are possible: (1) primary and (2) secondary. Primary pulpitis is the condition that results from direct injury to the pulpal tissues through the formation of dental caries or by other traumatic causes. Secondary pulpitis usually is due to the patient's general health condition.

You studied in the last section the cause and effect relationships that result in inflammation, and you now understand that this is nature's way of fighting infection. This defensive mechanism usually provides the means for neutralizing the irritants and eliminating tissue debris.

197

However, within the confining walls of the pulp chamber, the ability of the pulp to recover is limited.

The accumulating fluids and gases of inflammation cause a pressure on the still partially functioning nerve fibers—and this causes tremendous pain. As the pulpal inflammation increases, the pain becomes continuous and throbbing, and it intensifies if the patient applies heat or reclines. Not only does the pressure affect the nerve fibers, but edema also causes pressure on the blood vessels. This pressure can intensify enough to block the blood flow. To heal the damaged pulp, an increased supply of blood is necessary. If the blood flow is blocked, and since the pulp has no secondary blood supply, the normal inflammatory mechanism of healing usually cannot occur. Therefore, the pulp begins to die. The entire pulp may gradually be destroyed. It is extremely difficult to save a tooth from extraction at this stage except by root canal treatment.

The type of injury to the pulp determines whether the tooth can be saved. Tooth injuries usually are considered as either mild or severe. In a mild injury, the growth of the secondary dentin is stimulated, and in some instances, the dentinal tubules calcify. In severe injury, the pulp cells degenerate; secondary dentin does not form; connective tissue fails to form fibers; the walls of the blood vessels cease to function; and finally, the pulp dies.

Etiology of primary pulpitis. The most common cause of primary pulpitis is extensive tooth decay. The more severe the caries, the greater is the damage to the pulp. This type of pulpitis also may be the result of irritation by chemical substances, thermal changes or trauma sufficient to injure the cells of the pulp.

Etiology of secondary pulpitis. Secondary pulpitis is an inflammatory condition of the pulp chamber due to a systemic disease and is a secondary effect of a more prominent disease of the body. It is exhibited by swelling of the blood vessels within the pulp chamber.

Sometimes a sinus irritation will cause the blood vessels that course through the maxillary sinus to become enlarged within the pulp chamber. More frequently, the protective sheath for the nerves which course through the infected sinus membrane becomes irritated. This causes the patient to believe the pain stems from his or her teeth rather than from the sinuses. Such a sensation is known as *referred pain*.

Signs and symptoms. In the conditions of acute pulpitis, the tooth is extremely sensitive to heat but is relieved by cold applications. A person experiences a piercing and pulsating pain when lying down and, thus, the pain is more severe while they are in bed at night. Also, the pain may be increased by pressure or percussion. Pain experienced with acute pulpitis is more severe than that of simple dental caries or chronic pulpitis because of the inflammation of the pulp tissue within the pulp chamber and apical bone. Bacterial acids causing minor inflammation of the pulp chamber is a prime cause of chronic pulpitis. Also, in chronic pulpitis there is only a dull, obscure pain, usually no pain with percussion, very little pain with heat, and the pulp is still vital. Normally, this stage of pulpitis precedes acute pulpitis. In some cases, however, even before any bacteria enter the pulp, their byproducts may reach it and induce such changes in the pulp tissue as edema, hyperemia, and other inflammatory processes. Since the pulp is contained in hard and unyielding walls, the swelling produced by such processes as edema and hyperemia causes pressure and may soon result in the death of the pulp. Refer to table 3-1 to see the stages of primary pulpitis, the etiology, and the signs and symptoms of each stage.

Treatment. Treatment of pulpitis in its early stages is usually performed in the restorative section of a dental clinic. This treatment may consist of removing the irritation and inserting a sedative filling. In the later stages of pulpitis, treatment is normally performed in the endodontic section. The treatment at this stage may be what is called a *pulpotomy* (removal of the coronal portion of the pulp). Should pulpitis lead to necrosis of the pulp of the tooth, the tooth is said to be nonvital. A nonvital tooth is treated in either the endodontic or oral surgery section. The treatment of a nonvital tooth in the endodontic section essentially entails removing the necrotic pulp and replacing it with a suitable root canal filling. A nonvital tooth that cannot be treated by endodontics is usually extracted.

Exercises (262):

1. What is pulpitis?
2. What is the most common cause of primary pulpitis?
3. What is secondary pulpitis?
4. What type of pain is usually experienced with chronic pulpitis?
5. What may happen to the pulp as a result of the pressure produced by swelling caused by edema and hyperemia?
6. How is pulpitis treated during its early stages?
7. What treatment would be performed on a tooth that has become nonvital as a result of pulpitis?

TABLE 3-1
STAGES OF PRIMARY PULPITIS

STAGES	ETIOLOGY	SIGNS AND SYMPTOMS
1. Hyperemia	Irritants to pulp 1. Decay near, but not into, pulp chamber. 2. Exposed dentine-chipped. 3. Small pulp exposure. 4. High restoration or heat from dental drilling.	1. Tooth sensitive to cold-heat feels better. 2. Tooth sensitive to touch-smarts while chewing. Pain is short and sharp. 3. Pulp tester reads very sensitive (low reading).
2. Acute pulpitis*	1. Decay into pulp chanmber. 2. Beginning of infection in chambers 3. Progresses from untreated hyperemia.	1. Tooth sensitive to heat and cold. 2. Pulp tester reads like hyperemia. 3. Severe pain-whole side of head aches.
3. Chronic pulpitis	Infection progresses from untreated acute pulpitis.	1. Usually no pain. 2. May feel itchy and elongated due to formation of abscess. 3. Heat hurts-cold feels better. 4. Very high reading on tester.
4. Necrosis	Entire pulp chamber is necrotic or suppurative from progression of chronic pulpitis. Forms abscess.	1. Usually very painful with throbbing, boring pain due to pressure of suppuration. 2. Cold relieves pain a bit. 3. Swelling-toothache. 4. No reading on pulp tester.

* Secondary pulpitis is always acute, coming from a general body condition with the same symptioms as pulpitis.

263. Define abscess and indicate the two types of abscesses, their locations, signs and symptoms, treatment, and the condition that may result if an abscess goes untreated.

Abscesses. An abscess by definition is a localized collection of pus in a cavity formed by the disintegration of tissue. To understand this more clearly, let's break this definition down to its simplest meaning. To localize something, we limit or confine it to a particular place, area, or locality. Pus is an inflammation product consisting of cells, leukocytes, liquor puris (the liquid portion of pus), and organisms that identify the type of abscess. Disintegration is the decay or separation into fragments. Thus, an abscess is a collection of cells, liquor puris, and organisms in an area limited to one region with one or more spots formed by the decomposition or decay of tissue.

Periapical abscess. The most common condition following untreated acute pulpitis is a periapical abscess. A periapical abscess is the localized collection of pus at the apex of a tooth and may be classified as either acute or chronic.

An acute periapical abscess is a rapidly progressive inflammatory process in that the surrounding tissues become swollen and red. Usually, pus forms within 24 hours. The area becomes extremely painful and the abscess rapidly increases in size, with pus searching for an outlet. The tooth may be extruded slightly from its socket. The periodontal ligaments that are damaged due to the abscess may cause the tooth to become loose. The tooth is very sensitive to percussion and the body temperature may be elevated. When heat is applied to the offending tooth, the pain is increased. However, when cold is applied the pain is decreased. tester is used, no reading will be recorded, indicating the necrotic condition of the pulp.

The chronic periapical abscess is a condition which is of much longer duration but which is less painful and with little tendency to spread. As a rule the pain occurs only when pressure is placed on the tooth in a certain direction. When a pulp tester is used to check this condition, normally no readings are obtained. In most instances, the abscess is walled off; however, the membrane is usually attached more firmly to the bone than to the root of the tooth. There is very little redness or swelling involved (see fig. 3-1).

If an abscess remains untreated, it will continue to progress in the direction offering the least resistance. Eventually, a fistula will form and allow the pus to drain. The accumulated pus eventually penetrates the cortical plate to emerge into the gingival tissue and form a parulis (gum boil). In most cases, there is a swelling of the face in

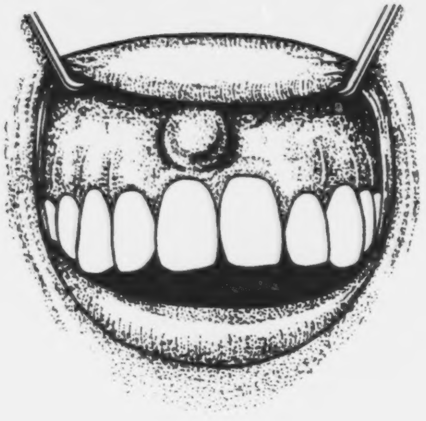


Figure 3–1. Periapical abscess.

the area of the abscess. If the infection does not localize, then a hard, boardlike swelling called *cellulitis* spreads through the tissue and wide areas of the face and neck. Usually, a constant, pulsating pain is experienced while the abscess is forming. However, when drainage is established, the pain is almost instantly relieved. People have been known to have a draining abscess for years and experience little or no pain or swelling.

Parietal (periodontal) abscess. This abscess more often develops alongside the tooth. It locates between the gingiva and it the tooth, and involves the periodontal ligament and the supporting alveolar bone. The parietal (par-eye′-eh-tul) abscess may undergo both acute and chronic changes as it progresses toward resolution, and it has to be treated according to the stage of tissue inflammation.

Usually the etiology of a parietal abscess stems from a foreign body irritant which becomes embedded in the space between the tooth and the soft tissue or completely within the soft tissue adjacent to the tooth. The most common cause of parietal abscesses are calculus formations, overhanging fillings, popcorn husks, and toothpicks that become wedged in the interproximal areas. Another cause may be a deep gingival or periodontal inflammation that becomes walled off. This prevents drainage and results in acute swelling.

In the acute stage of a parietal abscess, a typical inflammatory reaction occurs within the tissue. Ordinarily, the gingiva around the abscess is very swollen. Too, there may be swelling of the face and, occasionally, enlargement of the regional lymph nodes coupled with a slight elevation of body temperature. Pain associated with the lesion may vary from mild to quite severe. The tooth is rarely sensitive to percussion; however, pressure on the inflammed gingiva is quite painful. Application of heat or cold to the inflamed area causes no particular increase in the pain. The mucous membrane appears red, swollen, and inflammed, and is quite tender. The degree of swelling depends upon the extent of the infection. When drainage is completed, the pain or discomfort will disappear.

Cellulitis. Cellulitis is an inflammation of the soft tissue structures. It may occur as a complication from a dentoalveolar abscess or as a postoperative complication following extensive surgical procedures in the mouth. In either event, the signs and symptoms are quite similar. The onset of a cellulitis of the oral structure is manifested by edema of the soft structure—quite often extensive, as shown in figure 3-2. Pain is usually dull and persistent, and it increases with pressure. As the inflammation becomes localized, the central area may assume a red, shiny appearance. A high fever is associated with cellulitis (104° F to 105° F), along with a rapid pulse and headaches. Trismus (spasm) of the involved masticatory muscles may occur. In some cases, rather than the typical abscess production, a chronic cellulitis follows the acute phase with persistent deep swelling. In other instances, severe and extensive inflammation is apparent from the onset.

Exercises (263):

1. Define an abscess.

2. Name the types and location of periapical abscesses.

3. Briefly differentiate between an acute and a chronic periapical abscess as to pain, redness, and swelling.

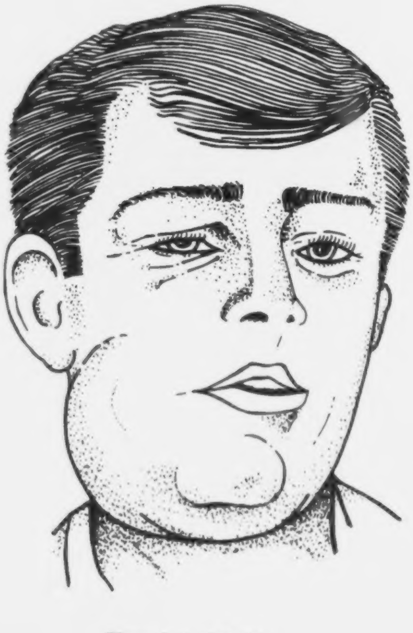


Figure 3–2. Cellulitis.

4. How is the pain associated with a periapical abscess relieved?

5. Summarize the usual etiology of a parietal abscess.

6. State the usual effect of heat or cold to a parietal abscess in regard to pain.

7. Summarize the signs and symptoms of cellulitis.

264. Analyze the eitology, signs, and symptoms of pericoronitis.

Pericoronitis. This is an inflammation around the crown of the tooth. Most frequently, it occurs around the crowns of partially erupted teeth, and, more specifically, the third molars or wisdom teeth. However, any partially erupted tooth may be affected. Figure 3-3 shows pericoronitis of the third molar. In this condition, a flap of gingival (gum) tissue called an operculum (o-per-ku-lum) extends over the unerupted portion of the tooth and, just as in a parietal abscess, it establishes an ideal pocket for the accumulation of food debris and the growth of bacteria. The environment is warm, dark, and moist. Consequently, such an area is ideal for the growth of bacteria. As the bacteria multiply under these conditions, an infectious process is initiated. It causes pain, pus formation, swelling, and, at times, trismus of the muscles of mastication in that particular area. With trismus, the patient has difficulty opening his or her mouth. Sometimes, it is impossible to open the mouth more tha one-half inch. Although this condition is usually brought about as the result of a partially erupted tooth, it may be aggravated by mechanical trauma and, as we have mentioned, by a secondary bacterial infection.

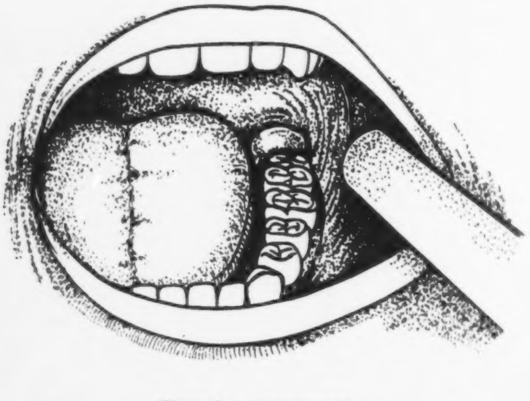


Figure 3–3. Pericoronitis.

There are many signs and symptoms associated with pericoronitis. The gingiva around the tooth is inflammed and swollen and it may extend into the adjacent tissue. There may be an accumulation of pus, along with severe throbbing pain and trismus of the muscles in the affected area. Fever and generalized cellulitis may develop in chronic cases. In most cases, pericoronitis lasts about a week if it does not become extensive and if the infection is not of an extremely virulent (infectious) type. In some cases, it may slowly disappear only to recur again in 3 or 4 weeks, unless the dental officer gives definitive treatment.

Exercises (264):

1. Give a brief description of pericoronitis.

2. What causes the pain, pus formation, and swelling associated with periconitis?

3. What is trismus?

4. What may develop as a result of chronic cases of pericoronitis?

265. Specify key facts concerning the etiology, signs, symptoms, and treatment of most common types of cysts and dental granuloma.

Cysts. While there are many types of cysts, the two most common types you will encounter in the treatment of dental patients are inflammatory and developmental cysts. Treatment normally consists of the surgical excision of the cyst, combined with a thorough curettage of the area to eliminate the rest of the cells that could lead to its recurrence. Of course, this treatment is performed by the dental officer.

Inflammatory cysts. An inflammatory cyst is caused by some irritant that usually can be identified. A chronic periapical abscess may cause the cells to proliferate (to reproduce in quick succession) and surround the abscess. If this epithelial sac successfully surrounds the chronic abscess, it prevents further bacterial growth by cutting off the source of nutrient. The pus gradually turns to a clear liquid. This sac or cyst may continue to enlarge by increasing the fluid inside the sac due to the exchange of fluids through the cyst wall. Cysts can form around retained roots or any foreign chronic irritant that may be buried in the tissue. A cyst is usually asymptomatic. This condition is usually caused by pathology of teeth.

Developmental cysts. Developmental cysts usually are composed of the cells that were left behind after performing a particular function. One good example of a developmental cyst is the follicular cyst. The tissue that formed the developmental sac during tooth formation causes this fluid-filled sac. Usually this sac disappears after its job is finished. However, in some cases, parts of it remain embedded in bone or attached to the tooth. Years later, the epithelial cells of the follicle begin to multiply and cause the follicular cyst. Additionally, remnants of this sac may be left behind during the third molar extraction. Since the third molar erupts comparatively late in life, it still may have some of the follicle attached. Although healing appears normal at the time, the cyst may appear some years later.

Dental Granuloma. A dental granuloma is a mass of granulation tissue, usually surrounded by a fibrous sac. It is a sequel to chronic inflammation of the periapical tissues. This chronic inflammation may be the result of necrosis of the pulp cells or it may be caused by nonpyogenic bacteria. The granuloma is located at the apex of the root, and the membrane that surrounds the granuloma often remains attached to the tooth as it is extracted. The tooth may be sensitive to percussion and feel slightly elongated; also, there may be a dull but persistent pain. However, in other instances, this condition may be present and offer no symptoms.

Exercises (265):

1. What usually causes an inflammatory cyst?

2. Where can a cyst form?

3. What happens to pus trapped inside a cyst?

4. What are developmental cysts composed of?

5. What is a granuloma?

6. To what condition is a granuloma sequel?

7. Where are granulomas usually located?

8. What symptoms may be noticed by a patient having a granuloma?

3-4. Periodontal Disease

Periodontal disease causes the loss of more adult teeth than any other condition. While the disease commonly affects people over 35 years of age, it is a serious threat to the dental health of patients of all ages groups. Inform your patients who are parents that periodontal disease begins in childhood (as early as 4 to 6 years of age) and progresses through life unless stopped before damage is done. You can compare advanced periodontal disease to a strong house with a weak foundation. A patient may have teeth that are free from decay, but they may be supported by weak, diseased, degenerated tissue. In this section we discuss how periodontal diseases are classified. Also, we discuss gingivitis, periodontitis, and periodontosis.

266. Name the two classifictions of periodontal diseases, and given a list of these diseases, match each with its correct classification.

Classifiction of Periodontal Diseases. Because there are many different types of periodontal diseases, there must be a means of classification. The two primary types are inflammatory and degenerative diseases.

Inflammatory diseases. Inflammation is the primary response of periodontal tissues to irritants and is usually the most easily recognized. *Gingivitis* (inflammation of the gingiva) and *periodontitis* (inflammation of the gingiva and the tooth supporting structures) are inflammatory diseases.

Degenerative diseases. Degenerative diseases are those in which the size, structure, or metabolism of cells is altered as a result of disease. The degenerative diseases are as follows:

a. Atrophy (reduction in size of a cell).

b. Gingivosis (chronic desquamative gingivitis).

c. Periodontosis (a degenerative disturbance of the periodontium).

d. Occlusal traumatism (injury to the periodontium, associated with abnormal or damaging forces of occlusion).

Exercises (266):

1. Name the two classifications for periodontal diseases.

2. Match the classifications listed in column B with the disease listed in column A. Column B items may be used more than once.

Column A	*Column B*
____ (1) Gingivosis.	a. Inflammatory disease.
____ (2) Periodontosis.	b. Degenerative disease.
____ (3) Periodontitis.	
____ (4) Atrophy.	
____ (5) Gingivitis.	

267. Define gingivitis, and distinguish between the six types in terms of their causes, signs and symptoms, treatment, and control.

Gingivitis. The term "gingivitis" refers to an inflammation of the gingiva. This is the most common ailment that you treat in the dental clinic.

There are a number of methods of classifying gingivitis. It can be treated according to its etiological factors or degree of inflammatory process. It also may be classified according to its anatomic location and distribution, or clinical features. Since enlargement of the gingiva is one of the most common clinical findings, we will base our discussion of gingivitis on this feature.

Chronic Generalized Marginal Gingivitis (Simple Gingitivis). This condition is often referred to as simple gingivitis because the etiology was originally believed to be local irritants only, but subsequent research has shown that there are also predisposing (making susceptible) and systemic factors involved.

Etiology factors. Local factors include plaque and calculus accumulations, mechanical irritants (improper brushing and flossing techniques, mouth breathing, occlusal trauma), and rough or sharp tooth edges caused by caries. There are many predisposing factors which that further aggravate an already irritated periodontium. Some of these factors are tooth anatomy, tooth position contacts, the occlusal plane relationship, width of the attached gingiva, the crown-root ratio, and the contour of the alveolar bone. When any of these factors exists as an irritant, the patient should receive an explanation of their anatomic problems that interfere with cleaning the mouth and allow the gingiva in those areas to be more susceptible to gingivitis. Systemic diseases may allow the gingiva to respond to local irritants in an exaggerated manner. There are, however, no systemic diseases that actually *cause* gingivitis.

Symptoms. The clinical picture varies from case to case, but normally certain symptoms will be present. Usually there is a change in gingivae morphology—either enlargement or shrinkage of tissue. Continued inflammation usually alters the interdental papillary contour. The papilla may appear to enlarge laterally and/or coronally, or the papilla may appear to recede in the area directly apical to the contact, which leaves an open space and creates a concave or crater-like contour. Gingival pockets may then form. Gingival pockets produce an increase in the bulk of the gingiva *without* destroying the underlying alveolar bone and periodontal ligaments. In the sulcular areas of epithelial degeneration and ulceration, hemorrhage easily occurs when the tissues are touched by a periodontal probe or other mechanical irritant. In inflammatory gingival disease, the gingival margin changes from a normal color to a darker, redder or blue-red color. The color change is dependent upon the pigmentation of the patient's gingiva. The gingival surface may appear swollen, smooth, and shiny because of the added fluid. It also may appear as a bright red because of its increased vascularity. Therefore, the color will depend upon the patient's ethnic group.

Treatment. Treatment of marginal (simple) gingivitis is directed toward early elimination of the etiological factors. This includes a systemic evaluation, removal of supra- and sub-gingival irritants, oral prophylaxis, and oral hygiene instructions. Predisposing and systemic factors should be treated by a dental officer and/or a physician.

Hyperplastic Gingivitis (Hyperplastic Enlargement). When inflammation is associated with enlargement of the gingiva, we call it hyperplastic gingivitis. The gingiva is neither red nor painful but it is grossly enlarged. The gingiva appears to be fibrous in nature. The cause is often idiopathic. It may be caused by a patient's partial dentures or other artifical appliances. It also may be caused by certain drugs. For example Dilantin taken for epilepsy could cause Dilantin hyperplasia. It even may be hereditary. The treatment may be surgical excision by a dental officer.

Hormonal Gingivitis (Conditional Enlargement of the Gingiva). A hormone imbalance is responsible for this type of gingivitis. It is precipitated by poor oral hygiene. Hormonal gingivitis occurs during those phases of life when there is alteration of sex hormones—adolescence, pregnancy, and menstruation. The gingiva is enlarged, edematous, and red or bluish red. It is puffy and bleeds easily. Lesions initially involve the interdental papilla and later the marginal gingiva. Hormonal gingivitis is usually found in the anterior part of the mouth. It may involve a few or many teeth. This condition usually can be controlled by the removal of any irritants and good oral hygiene.

Desquamative Gingivitis (Gingivosis). This type is linked with the hormonal type but has different characteristics. There are numerous areas of the gingiva where the epithelium lifts off, leaving large, raw patches. Vesicles or blisters also appear and rupture, leaving a raw surface. This a very painful condition, and the patient may require topical anesthetics before meals. Treatment consists of improving oral hygiene and symptomatic therapy. Refer this patient to a dental officer.

Acute Necrotizing Ulcerative Gingivitis or NUG (Acute Generalized or Localized Gingivitis). This disease has been called many names. It has been called Vincent's infection and during World War I our soldiers who developed this mouth disease were said to have "trenchmouth." The Air Force uses the shortened term "NUG". In this type of gingivitis, the tissue of the interdental papilla is either dead or dying. The gingiva is swollen, red, and bleeding; the dead interdental papilla is covered with a gray-white pseudo (false) membrane. If you wipe the tissue with a gauze or a cotton swab, or if you squirt water on the membrane, it peels off and leaves a raw, bleeding surface. A fetid odor always is present. This odor has been described as a "very-stale-tomato- juice-can smell." In the acute stage, the patient has fever, his orher guns may be painful, and the patient may be unable to eat because of sore gums. The cervical lymph glands may be swollen the patient can feel pea-sized lumps below the mandible that are tender to the touch. The patient may suffer from malaise (a general feeling of illness). The ever-present symptoms and signs vary in intensity. Nonetheless, this disease is frequently misdiagnosed.

Necrotizing ulcerative gingitivis is caused by a vibrio, a bacillus, and a spirochete—anaerobic bacteria that get down into the tissues. When you take a smear and prepare a slide and you can see hardly anything but spirochetes, you can be reasonably sure you are viewing a case of NUG. (It is humorously said that if the spirochetes lift the glass cover slip from the slide, you can make a positive diagnosis of NUG!) From the patient's physical standpoint, the causes of NUG are usually poor oral hygiene, rundown physical condition, fatigue, and emotional stress.

There are several definite steps for the treatment of NUG. First, reassure the frightened patient because the condition happens suddenly and is painful. Many patients go to the dispensary receive an injection of penicillin sometimes before you can see them; this may give dramatic relief, but for only about 2 weeks. These patients are anxious and upset, so it is important for you to emphasize that the condition is a dental problem, but that with cooperation, it can usually be overcome in a week or two.

The second step is gentle debridement. Use the ultrasonic proplylaxis instrument to gently remove plaque and calculus. The ultrasonic tip is probably all you can get into the patient's mouth at this time. The warm water flushes away much of the debris and dramatic relief occurs in 24 hours. This treatment is quick and beneficial. Try to use a soft brush. Give the patient a mouthwash of 50 percent peroxide (3 percent strength) and water. Tell the patient to hold the solution in his or her mouth as long as possible and then expels it. Repeat this treatment four times a day for 3 days. Also tell the patient not to eat spicy foods, to use little salt, to refrain from smoking, and to take lots of liquids like milkshakes, but not to drink citrus drinks.

See the patient again within 24 to 48 hours. If you and the patient both have performed conscientiously, you should be able to see a marked improvement when he or she returns. When you see the patient again, he or she will be ready for a definite debridement. If you have seen the patient in the early stages, usually the interdental papilla can be saved; otherwise, it may already be gone. So give the initial treatment as early as possible.

Exercises (267):

1. Define gingivitis.

2. List four local factors that can cause marginal gingivitis.

3. What may be the appearance of the gingival surface of a patient who has marginal gingivitis?

4. What is the treatment of marginal gingivitis directed toward?

5. Who should provide treatment for the predisposing and systemic factors related to marginal gingivitis?

6. When Dilantin is taken for __________ it could cause dilantin hyperplasia.

7. Inflamation associated with enlargement of gingiva is known as __________ __________.

8. Name the signs and symptoms of hormonal gingivitis.

9. How can you control hormonal gingivitis?

10. What are the characterisitcs of desquamative gingivitis?

11. What are the signs and symptoms of necrotizing ulcerative gingivitis?

12. What causes necrotizing ulcerative gingivitis?

13. What is the first step in the treatment of NUG?

14. What is the second step for the treatment of NUG?

268. Define periodontitis, and analyze its causes, signs, symptoms, and treatment.

Periodontitis. This is an inflammation of the periodontium, including both the gingiva and tooth attachment apparatus. The main difference between gingivitis and periodontitis is in the anatomical parts involved. In gingivitis the marginal and papillary tissues are inflammed. When the inflammation extends and destroys the transseptal fibers, and the supporting structures of the tooth break down, the condition is no longer gingivitis but is periodontitis. If gingivitis is properly diagnosed and treated, it should not progress to periodontitis.

Periodontitis is caused by the same local irritants that cause gingivitis. These irritants may be materia alba, plaque, calculus, food impaction, overhanging margins of restorations, roughened or cracked restorations, or sharp edges of carious teeth. The condition also can be aggravated by systemic factors, such as low resistance, fatigue, stress, diabetes, blood problems, and hormone imbalance. If a patient has diabetes, for example, neither you nor he or she should expect dramatic healing.

When you look into the patient's mouth, you may notice a pungent odor. You also may notice some, all, or none of the above-mentioned irritants. The surface of the gingiva may be edematous or fibrotic. Exudate (pus) may be present within the periodontal pocket.

Another technique used to assess the condition of the periodontal tissues is the X-ray film. You are aware of the limitations of X-ray. It is not 3-dimensional; it portrays only length and height but not depth. The periodontal probe also can be used as an aid in the clinical examination. If the interproximal alveolar bone shows a slight blunting, you can assume that periodontitis is in the beginning stages. On the other hand, a horizontal loss of bones and cupping-out of interproximals, then you know that you are working with an advanced case of periodontitis.

The treatment consists of educating the patient toward better oral hygiene and removing the local irritant if you can find it. Then the pocket should be removed, and possibly the dental officer will recontour the gingival bone. Actually, you may think of the treatment for periodontitis as having four possible distinct steps:

(1) Education of the patient.

(2) A conservative treatment of scaling and curettage. If there are systemic factors, the patient should be sent to a physician. If these steps are not the answer, the following steps could be executed.

(3) Gingival surgery and possible osseous (bone) surgery.

(4) Postoperative treatment, which includes occlusal equilibration and reevaluation.

Exercises (268):

1. What is periodontitis?

2. What are some of the systemic factors that can cause periodontitis?

3. What indicates an advanced case of periodontitis?

4. If the first two steps of treatment for periodontitis fail, what is the third step?

269. Define periodontosis, and cite the signs and symptoms of the three stages.

Periodontosis. This is an uncommon occurrence of a nonspecific, noninflammatory, degeneration of the periodontium. No one is sure what causes the disease. It can be a systemic occurrence such as diabetes; it can be the result of early childhood malnutrition or infectious disease; it can be a defect in collagen matabolism; or a genetic factor may be involved. Dramatic bone loss first appears in the region of the first molars and incisor teeth. The rest of the teeth may be in good condition. The disease initially occurs most often in the 15- to 25-year age group in both males and females.

The appearance of periodontosis in its early stage (first stage) is widening of periodontal spaces, loss of the lamina dura, and bone loss. During the second stage, the earliest sign of inflammatory involvement from local irritation is seen. The third stage is characterized by progressive gingival inflammation, trauma from occlusion deeper periodontal pockets, and increased bone loss. Often the patient does not arrive at the clinic until this stage, and when he or she does, the condition is often wrongly diagnosed as periodontitis. Another clinical appearance of periodontosis is the loosening and drifting of teeth. Neither pocket formation nor bone loss is part of the beginning process of periodontosis but is seen in the later stages.

The first step in the treatment of periodontosis is to attempt to diagnose it. Then get the patient to a dental officer who in turn will refer the patient to a physician to determine if systemic factors are involved. If so, the systemic condition should be controlled first, after which the dental treatment may be the same as for periodontitis. You must educate the patient toward good oral hygiene, then clean the mouth area. The dental officer then treats the patient according to his or her needs. This treatment may include equilibrating, splinting, or extracting those teeth beyond hope of saving. Prognosis for the teeth involved in periodontosis is very poor.

Although caries causes some extractions, periodontal diseases account for approximately 90 percent of tooth loss. Good oral hygiene helps to keep the teeth in good condition. Remember that periodontal disease is the end result of poor oral hygiene.

Exercises (269):

1. Define periodontosis?

2. What is the appearance of periodontosis in its early stage?

3. During which stage is the earliest sign of inflammatory involvement seen?

4. How is the third stage of periodontosis characterized?

3-5. Anomalies and Pathology of the Oral Cavity

You may question why you should be concerned with the anomalies and pathology of the oral cavity. There are so many manifestations, and there is little you can do about them. Remember, your purpose for being in the dental clinic is to give the best possible service to each of your dental patients, assisting them in any way you can. One way of assisting the patient is to recognize any unusual condition in the mouth and to know when to refer him or her to a dental officer for further observation and treatment. There are many magazines, journals, and commercial books on dentistry available. Read these publications seriously. If you form the habit of being observant and if you study, you can be valuable to both the patient and the dental officer. Your personal reward is self-improvement. In this section, we can give you only a start toward a deeper understanding of your career field. We will discuss briefly only a few manifestations you will most likely encounter.

It is impossible to overstress the importance of observing every lesion found in the patient's mouth. If you have any doubt about the type of lesion, have your questions answered before the patient leaves your care. If you see any type of lesion in the patient's mouth, check it out. If you identify a sign, you will be performing a service to your patient. We will discuss the more common manifestations that are confined to the oral cavity, those having manifestations on the body as well as the oral cavity, and those that are due to nutritional deficiencies.

270. Identify the oral manifestations of systemic disorders that are confined to the oral cavity.

Oral Manifestations Confined to the Oral Cavity. These manifestations have characteristics that are only visible in the oral cavity.

Leukoplakia. This condition is responsible for approximately 13 percent of the white lesions of the mouth. It often appears as a white opalescent (iridescent) plaque in the mouth. This lesion also can occur on any mucosal surface, but it is most often seen on the cheek or lip and may be any size. The size may be static or it may increase. The lesion usually is the result of an irritation of long duration—such as smoking, lip biting, or constant contact with a rough tooth surface or calculus. You see the lesion most in patients between the ages of 50 and 60 years of age and in males more often than females. Although leukoplakia is not cancer, it may be premalignant. If untreated, about 25 percent of cases become carcinomas. The treatment is total excision. Call any such lesion to the attention of the dental officer.

Lichen plantus. The exact cause of lichen plantus is not clearly understood. Some authorities believe that overworking, nervousness, and fatigue may be the underlying causes. Lichen plantus may occur at any age. The most common places of occurrence are on the top and the sides of the tongue and on the buccal mucosa (cheek) opposite the upper and lower molars. Clinically, lichen plantus is characterized by small, bluish-white, glossy areas that have a definite lacelike pattern. The lesion is hard and rough to the touch. Usually no serious consequence results from the lesion, but it should be in all cases distinguished from leukoplakia. The dental officer's attention should be called to the above lesion.

Nicotina stomatitis. This inflammation of the oral mucosa is due to the tar products of tobacco. It usually is located on the hard palate, particularly around the palatal mucous gland ducts. It starts as a red irritation and later becomes white. The disorder predominates in the adult male—especially the pipe smoker. The treatment is to simply remove the cause. The condition may be premalignant; however, if the patient stops smoking, the prognosis is excellent.

Hairy tongue. Usually the location of this condition is on the top surface or the dorsum of the tongue. You see it as long elongations of filiform (threadlike) papilla. The condition is asymptomatic. However, if food debris collects between the "hairs," a secondary infection may follow—resulting in an infected, painful tongue. Daily brushing or scraping of the tongue helps to prevent the secondary infection. Although the cause of the disorder is unknown, allergies and fungi have been suggested as possible sources. The papilla elongations are white, but they can be discolored black or blue by something the patient has ingested—food, medication, tobacco, or liquids.

Candidiasis (kan-did-eye-ah-sis) (moniliasis). This is a fungal infection (candida albicans) located anywhere on the oral mucosa. The disorder appears as multiple, white, cordlike patches. It usually appears in infants and the elderly. In an infant, the disorder is sometimes called thrush and may occur after taking oral antibiotics. The antibiotics sometimes produce an imbalance. the oral flora of In the elderly, the cause is often debilitation, resulting from age, alcoholism, leukemia, or diabetes. The white patches respond to a topical application of nystation.

Fordyce granules. This is a developmental anomaly (a marked deviation from the normal standard). These spots are deep-seated, malpositioned, sebaceous (sah-bay'-shahs) skin glands which appear as numerous white or yellowish, cheesy grandules. They may appear as clusters or granules and are located just beneath the epithelium on the occlusal plane level of the cheek and on the lip mucosa. This condition is seen in approximately 80 percent of the patients. These spots are not of clinical concern.

Geographic tongue. This condition is manifested on the dorsum of the tongue. The lesions are irregular red patches of desquamation (sloughing). The surrounding area of the tongue remains white because of the elongation of the papilla. The lesions move from location to location. There is no known cause and no known treatment. Some believe that vitamin B complex may help.

Herpetic gingivostomatitis. Primary herpetic gingivostomatitis is caused by the herpes simplex virus and is most often seen in children (both sexes) between ages 1 and 3 years. This condition usually infects the entire oral mucosa. The condition causes headache, pain, sore mouth, drooling, and irritability. Fever may accompany the condition. When the virus is activated, the oral mucosa becomes red, and numerous blisters (vesicles) appear. Where these rupture, they form painful ulcers which are usually self-limiting. If the blister forms on the skin or lip surface, it is called a cold sore. It is not so painful and usually remains only a few days. The infection then has the tendency to remain dormant in the cells. Later, when the systemic resistance is low and the patient has a high fever, or if their lips are overexposed to the wind or sun, the infection recurs. This disease is usually preceded by some other infectious process such as a respiratory problem. When it recurs it is known as secondary herpetic gingivostomatitis. The lesions of this stage of the disorder usually heal after 7 to 14 days.

Herpes simplex. Herpes simplex is a common infection usually occurring on or about the lips—often referred to as a cold sore or fever blister. The cause of this lesion is not fully understood. It sometimes appears as a corollary of a common cold, upper respiratory tract infection, allergy, gastrointestinal distrubance, overexposure to sunlight, fatigue, or emotional tension. Whether these factors actually cause the disease, or just contribute to it, is not known. At times, it appears without obvious cause. The herpes simplex virus has been identified as the primary causative organism.

The patient may feel an itching or burning sensation prior to the eruption of one to several water blisters (vesicles). These vesicles break and crust over. The area usually is surrounded by redness and is slightly swollen. Normally, the lesions are painless but become sore if the vesicles break and leave a raw surface. Herpes simplex is usually self-limiting and heals in 10 to 14 days without scarring.

Keep irritating drugs and spicy food away from the lesion by coating the lips with vaseline or some other preparation. This is palliative (soothing but not curative) treatment.

Aphthous stomatitis. This bothersome ulcer, sometimes called a canker sore, is found in the mouth on the mucous membrane. Its exact cause is unknown, but a certain type of streptococcus may be a causative factor. The ulcer appears to be associated with gastrointestinal disturbances in individuals whose resistance is low and in persons who are suffering from physical or emotional stress. The term "stomatitis" refers to any inflammation of the mucous membrane of the mouth, while "aphthous" refers to vesicles which tend to form and then break down and produce ulcers.

These ulcers appear as depressions on the mucous membrane and are covered by a grayish-white or a light-yellowish membrane. Each such lesion is preceded by a vesicle that normally persists for only a few hours before rupturing and producing the ulcer. The ulcers vary in size from that of a small pinhead to one-half inch at their greatest dimension. Aphthae may occur in various parts of the mouth, but are most common on the lip, cheek, floor of the mouth, and tongue.

Once again, palliative treatment keeps the patient comfortable until the ulcers subside. Soothing rinses and application of surface anesthetics may be of some value. The patient is instructed to stay away from spicy or irritating foods.

Amalgam tattoo. This is a pigmented lesion of the oral mucosa. The pigmentation presents a dark coloring, caused by the accidental implantation of amalgam into the tissue or by prolonged contact of the tissue with the amalgam. There is no treatment available. Excision may be used for cosmetic reasons.

Sialadenitis (Sy-uhl-ad-en-eye'-tis). This is inflammation and infection of a salivary gland. It presents itself as an inflammation of the major ducts or as salivary stones. The most common form of the disorder is mumps. The patient is treated with drugs except when stones are present, a condition which requires surgery. The prognosis is excellent.

Mucocoele (mu'-koe-seal). Mucocoeles are retention cysts which occur most commonly on the lower lip. They also may form in the cheek, upper lip, and lower surface of the tongue. They rarely are found on the palate. Mucocoeles appear as a round or oval translucent swelling. Generally, they are a bluish or greenish color and vary in size from a pea to a bean. Mucocoeles are the result of an accumulation of mucus which has occurred because of the stopping up of the excretory duct of a mucous gland. Stoppage of the duct may result from lip biting or from other similar injuries. The treatment for mucocoeles is excision.

Exercises (270):

1. Match the characteristics listed in column B with the appropriate condition in column A. Each description listed in column B will be used only once.

Column A

_____ (1) Sialadenitis.
_____ (2) Leukoplakia.
_____ (3) Nicotina stomatitis.
_____ (4) Candidiasis.
_____ (5) Amalgam tattoo.
_____ (6) Mucocele.
_____ (7) Geographic tongue.
_____ (8) Lichen planus.
_____ (9) Herpes gingivostomatitis.
_____ (10) Fordyce granules.
_____ (11) Hairy tongue.
_____ (12) Herpes simplex.
_____ (13) Aphthous ulcer.

Column B

a. This condition is responsible for approximately 13 percent of the white lesions of the mouth.
b. Has small bluish-white, glossy areas that have a definite lacelike pattern.
c. Due to the coal tar products of tobacco.
d. You see it as long elongations of filiform papilla.
e. Appears as multiple white cordlike patches.
f. Deep-seated, malpositioned, sebaceous skin glands that appear as numerous white or yellowish, cheesy granules.
g. The lesions are irregular red patches of desquamation.
h. The oral mucosa becomes red and numerous blisters appear.
i. This is an inflammation and infection of a salivary gland.
j. Caused by prolonged contact of the tissue with amalgam.
k. Retention cysts that occur most commonly on the lower lip.
l. The patient may feel an itching or burning sensation prior to the eruption of one to several water blisters (vesicles).
m. The ulcers vary in size from that of a small pinhead to one-half inch at the greatest dimension.

271. Identify the characteristics of systemic disorders which have manifestations that are not confined to the oral cavity.

Systemic Disorders Not Confined to the Oral Cavity. These disorders have oral manifestations as well as manifestations elsewhere in the body.

Hemangioma (Hee-man"jee-oh'mah). This type of tumor is made up of small blood vessels and is usually congenital, or it may appear soon after birth. It usually appears on the cheek, tongue, or lip. It appears as an elevated (or partially elevated) lesion and can be any size. It has a smooth surface and a somewhat red or blue color. The tumor is soft and impressible and may blanch when slight pressure is applied. The tumor may regress spontaneously; or it may require surgery or electrocautery. The prognosis is excellent.

Herpes zoster. This disorder resembles herpes simplex. Both are acute virus diseases marked by watery blisters on the skin and mucous membranes on the border of the lips, the buccal mocosa, the tongue, or the soft palate. The lesions run in lines following the pathway of a sensory nerve, indicating that they are a virus infection of a nerve. The disorder is often called *shingles*. A topical anesthetic application may give temporary relief. It is usually unilateral in appearance, which is one of its most distinguishing features.

Infectious mononucleosis. This disease, although a systemic problem, can manifest itself anywhere on the oral mucosa and is found primarily in young adults. The disorder exhibits multiple oral lesions and consists of numerous small ulcers. These oral signs normally appear before the general manifestations of the disease or any other symptoms occur. The condition is attended by fever, malaise, sore mouth, lymph gland enlargement, and loss of appetite. The disorder is probably caused by a virus.

Syphilis. This highly contagious disease can be a threat to the dental staff personnel who touch infected patients with their bare hands. Syphilis is a venereal disease which may manifest itself in the mouth. Though it is not common, transmission can occur to the hands from lesions in the mouth. Syphilis is caused by a specific bacterium called *Treponema pallidum*, a spirochete. It can enter the body through any break in the skin, such as hangnails and blisters. Syphilis is characterized by three stages.

The first stage of syphilis is charaterized by appearance of the lesion called the *chancre* which appears approximately 3 weeks after exposure. The *chancre* (shang'ker) may appear anywhere on the body, but the most common sites are on the genitals, on the lips, or in the mouth. Clinically, in the oral cavity, it is characterized by an ulcer formation with a hard border, having an appearance similar to an aphthous ulcer. Because it is usually painless, the patient is often unaware of its existence. The chancre normally is a single lesion, although rare cases of two or more have been reported. Any single, painless, untreated lesion appearing on the lips or in the mouth should be called to the dental officer's attention at once and should be viewed with suspicion until steps are taken to secure confirmation by laboratory procedures. The chancre is highly infectious, and although it is most commonly found on the genitals, its appearance in the mouth is not rare. The dentist and the dental assistant should never overlook the possibility of its presence. The chancre goes away within 2 months, leaving variable scarring.

A dangerous *secondary lesion* appears 6 to 8 weeks after exposure. It is the result of a generalized involvement of the blood and the lymphatic circulation. The causative organism enters the bloodstream at the site of the primary lesion, multiplies, and is carried throughout the body by the circulatory system. The secondary lesions may appear anywhere on the body and in large numbers. If lesions appear on mucous membranes, they are known as mucous patches. These are probably the most contagious of all the syphilitic lesions and are seldom absent from the oral mucosa during the secondary stage of syphilis. The true mucous patch is a painless lesion that is usually oval in shape with a moist, glistening, grayish-white, slightly raised surface. Other secondary lesions, however, may have radically different appearances; it is this fact that makes the clinical diagnosis of secondary syphilis difficult. As in the case of the single primary lesions, the dentists and their assistants should view with suspicion any painless lesions of the mucous membranes of the mouth and throat. The dental officer will take the necessary steps for proper laboratory diagnosis.

The third and terminal stage of syphilis produces a lesion called a *gumma* (gum'-mah). It may appear to several years after the initial infection. Usually there are not very many lesions and often just one. The lesions in this stage are not considered very contagious, since they rarely contain the causative organisms. They may appear in the mouth but not with the same frequency as do the secondary lesions. The gummas normally appear as nodules and slowly increase in size, becoming softer and less dense. Eventually, the center of the nodule becomes eroded and a definite ulcer results. The soft tissue and underlying bone are destroyed. Perforations of the palate often result. The treatment of syphilis, regardless of the stage, is a medical problem. The patient's dental requirements will be met through close cooperation with the physician treating the systemic infection.

You may see malformed teeth in a patient who had congenital syphilis. The spirochetes affect the tooth formation, and the resulting teeth may be notched, pea shaped, or barrel shaped.

Papilloma. Papillomas are epithelial tumors that appear as a cauliflowerlike attachment to the surface epithelium. They may occur anywhere on the mucous membrane, especially on the palate, tongue, lips, and gingiva. The etiology of the papilloma is unknown. They may occur at any age; however, they most often are found in patients who are in their fifties or sixties. Until a papilloma is positively identified, it is a good idea to consider it as a potential malignancy. Treatment of a papilloma is excision.

Tuberculosis. The oral lesions in this disease are usually associated with pulmonary (lung) tuberculosis. The primary causative agent is the bacillus *Mycobacterium tuberculosis*. The spread to the oral cavity occurs either through the bloodstream or by direct contamination of an abrasion or wound in the mucosa. The most common site for this secondary tuberculous lesion is the tongue. If the oral lesion is a primary site, it may be caused by the direct contact of the tissue with an infected instrument.

Oral lesions, especially those of the lips, frequently begin as a small tubercle or pimple that breaks down to form painful ulcers. Additional tubercles form in the same manner as the process repeats over and over and the lesion grows in size. The tongue lesions are particularly painful, as they develop along the lateral borders of the tongue where it rubs against rough, sharp, or broken-down teeth and restorations. The pain is severe and continuous, and it interferes with eating. The patient suffering from this disease is in serious trouble. Management is a medical problem. The oral lesions are treated in the closest cooperation with a physician. The maintenance of good oral hygiene and the elimination of all areas that might be a source of irritation to the tissues is of primary dental concern. During the dental portion of treatment of diseases such as these where contact with the lesion could spread the infection to the operator, rubber gloves, face mask, and the strictest aseptic techniques are *mandatory*.

Measles. Measles is seldom dangerous but is highly contagious. If you have not already had this disease, then you are not immune, and you should stay completely away from an infected patient. Measles is a viral infection that usually produces lasting immunity once a person has had the disease.

One of the earliest signs of measles (rubeola) is Koplik's spots, an important diagnostic sign of the disease. They appear in the mouth 1 or 2 days before the rash. The spots are pinhead size and white or bluish white. They are surrounded by a red halo, usually found early on the soft palate along the line of closure in the molar region and later during the acute stages of the disease on the cheek mucosa. The disease will run its course in 14 to 21 days. Unless there are oral complications, measles is treated as a medical problem by a physician.

Mumps. Medically called *epidemic parotitis*, mumps is an inflammation of the parotid gland. Although primarily a viral infection, it is considered a systemic disease, because it also may affect the testicles, ovaries, pancreas, and brain. This acute, highly contagious disease should be viewed with suspicion by those who have never had the disease. Mumps must be differentiated from acute oral infections and cellulitis. Mumps is a highly contagious viral disease that usually imparts a lasting immunity to those who have been infected. Patients with swellings located at the angle of the mandible may be infected by this virus. Accompanying symptoms include irritability, fever, and headache. The swollen area is extremely sensitive to palpation. The medical clinic manages this condition.

Diabetes mellitus. This disease is due to insufficient secretion of insulin by the pancreas. Insulin is needed by the body for the digestion and use of carbohydrates. The cause may be hereditary, diet, or as a result of other diseases of the body.

Patients usually experience xerostomia (zair-oh-stome'-ee-ah) (dry mouth) and a sweetish odor to the breath. Diabetes mellitus impairs the body's healing ability. This factor causes diabetics to have increased tendency to develop periodontitis, glossitis, and gingivitis. They also develop infections easily. If oral surgery is performed, the patients usually exhibit healing difficulties and are often predisposed to alveolar osteitis.

Diabetes is a medical problem. It is not curable but can be controlled in most cases by oral medication, diet control, or insulin injection. If a patient is a controlled diabetic, his or her reaction to surgery and healing functions are about the same as those of normal patients. A patient having persistant gingivitis in spite of removal of local factors and good oral hygiene should be checked for diabetes.

Hepatitis. Although hepatitis is not an oral disorder, it is included here because the assistant can be so important in the control of its transmission.

Hepatitis is caused by viruses that defy isolation. There are two distinct types of the disease: *infectious*, or type A, and *serum*, or type B.

Infectious hepatitis (type A) is usually acquired by ingestion of contaminated food or water but can be transmitted by needle. The virus multiplies in the intestional tract and then invades the bloodstream, subsequently localizing in the liver.

Serum hepatitis (type B) also is known as *viral hepatitis*. It is estimated that in the United States, there are 900,000 unidentified carriers of this disease, and this number is steadily increasing. Two of the major sources of infection are blood transfusions and the use of unsterile needles.

HBV (hepatitis B virus) can be transmitted by any object that is transferred from one mouth to another or by any instrument that breaks the skin of an infected person and then used on another patient. The greatest hazards to dental personnel are the accidental needle puncture and handpiece spray from the mouth of an infected person.

If you have any reason to believe that you have been exposed to HBV, you should seek prompt medical attention. The incubation period may vary from 6 to 24 weeks, depending on the route of exposure. The time to seek preventive treatment is immediately after possible exposure to the disease. Do not wait for the symptoms to appear!

The manifestations of the disease vary markedly. In some patients, there is no clinical illness, merely abnormalities in chemical liver function. In others, the symptoms are anorexia (loss of appetite), nausea, vomiting, jaundice, fever, weakness, malaise, abdominal discomfort in the upper right quadrant, joint pain and urticaria (hives). The average minimum length of disability with the disease is 7 weeks.

Any patient who has ever had hepatitis should be considered to be a potential carrier until proven otherwise by laboratory testing. All instruments used in this treatment should be sterilized, not merely disinfected. All surfaces touched during treatment must be thoroughly wiped with an appropriate disinfectant. If treatment is necessary for a patient with active or a history of HBV, the dentist and assistant should protect themselves with face masks and gloves. A rubber dam also will help to limit the amount of contamination from the patient's saliva. If a dentist and assistant who have already had the disease are available, they should perform the treatment, since they will have developed an immunity.

Exercises (271):

1. Match the characteristics listed in column B with the appropriate condition in column A.

	Column A	*Column B*
____	(1) Herpes zoster.	a. Epithelial tumors that appear as a cauliflowerlike attachment to the surface epithelium.
____	(2) Hemangioma.	b. The primary causative agent is mycobacterium tuberculosis.
____	(3) Infectious monoucleosis.	c. One of the earliest signs of disease is Koplik's spots.
____	(4) Syphilis.	d. This disease is an inflammation of the parotid gland.
____	(5) Papilloma.	e. This type of tumor is made up of small blood vessels and is usually congenital.
____	(6) Tuberculosis.	f. The first stage of this disease is characterized by the appearance of a lesion called the chancre.
____	(7) Meases.	g. This disease is due to insufficient secretion of insulin by the pancreas.
____	(8) Mumps.	h. This disease is marked by watery blisters on the skin and mucous membranes on the border of the lips.
____	(9) Diabetes mellitus.	i. The disorder manifests itself in multiple oral lesions and consists of numerous small ulcers.
____	(10) Hepatitis.	j. This disease is caused by a virus that defies isolation. There are two distinct types of the disease, infectious and serum.

272. Given a series of descriptive definitions, identify the various types of tumors and the terminology that applies to them.

Tumors. The word "tumor," which means a swelling, describes an abnormal growth of tissue. The terms "non-neoplasms" and "neoplasms," meaning new formations, can, however, more accurately describe the pathological conditions.

Non-neoplasms. Non-neoplasms are different from true neoplasms in that the etiological factor can be identified. We already have discussed many overgrowths that are classified as non-neoplasms. These include the overgrowth of gingiva due to mechanical or bacterial irritants, granulomas, dental abscesses, and cysts.

Neoplasms. Neoplasms are uncontrolled new growths without an apparent immediate cause. They possess the potential for unlimited growth but are of no use to the body. The simplest way to discuss them is to classify them as either neoplasms or supporting-tissue neoplasms. Within both groups are malignant and benign types. Malignant neoplasms are referred to as cancers. Look at table 3-2 and compare the characteristics of benign and malignant neoplasms.

a. Epithelial neoplasms are abnormal growths of epidermal embryonic origin. Neoplasms of the skin and associated structures, including most glands, are placed in this group. Cancers of the skin are referred to as carcinomas; cancers of the glands are referred to as adenocarcinomas. A malignant lesion of the parotid gland would be called an adenocarcinoma of the parotid gland. A similar lesion affecting the mucosa of the palate would be called a carcinoma or epidermoid carcinoma of the palate. Benign overgrowths may have descriptive names but usually contain the suffix "oma." A benign neoplasm of the parotid gland is called an adenoma of the parotid gland. A benign lesion of the palate may be described a bit further as a papilloma, meaning that it is raised and resembles a wart. Warts are epithelial papillomas.

b. Supporting tissue neoplasms are abnormal growths of tissue of mesodermal embryonic origin. Neoplasms of the bony skeletal system and cartilage are included in this group. Cancers of the bone are termed "osteosarcomas" ("osteo" or bone "sarcoma" or "malignant neoplasm of"). Benign growths of supporting tissue are named by the same system used in the epithelial tumors. The benign tumors of the mouth include the "torus mandibularis" and the "torus palatines." These terms are examples of benign lesions. Torus means "a bulging." These neoplasms are actually osteomas. They are quite benign and need only be removed if they interfere with prosthetic appliances or bother the patient.

Exercises (272):

1. Match the type of tumor listed in column A with its most appropriate descriptive definition in column B. Use each descriptive definition only once.

	Column A	*Column B*
____	(1) Tumor.	a. Uncontrolled new growths without an immediate cause.
____	(2) Neoplasm.	b. A malignant lesion (cancer) of the gland.
____	(3) Non-neoplasm.	c. Abnormal growths of tissue of mesodermal embryonic origin.
____	(4) Epithelial neoplasms.	d. A new formation where the etiological factor can be identified.
____	(5) Carcinomas.	e. Abnormal growths of epidermal embryonic origin.
____	(6) Adenocarcinomas.	f. Word termination meaning "tumor" or "neoplasm" of the pat to which it is attached—usually used to indicate a benign growth.
____	(7) The suffix "oma" added to a descriptive name.	g. Means a swelling; describes an abnormal growth of tissue.
____	(8) Supporting tissue neoplasms.	h. A bulging bony tumor of the mouth, specifically on the lingual surface of the mandible.
____	(9) Ostemoa.	i. A hard tumor of bone-like structure developing on a bone.
____	(10) Torus mandibularis.	j. Malignant neoplasms.
____	(11) Benign.	k. Tending to become progressively worse.
____	(12) Malignant.	l. Not malignant, favorable for recovery.

TABLE 3-2

BENIGN AND MALIGNANT NEOPLASMS

BENIGN	MALIGANT
Grows slowly by enlargement.	Grows rapidly by invasion.
Confined or encapsulated.	Not confined; borders ill defined.
Does not metastasize (the transfer of disease from one organ or part to another not directly connected with it).	Metastasizes through the circulatory system to form a new foci of the disease.
Not likely to recur after removal.	May recur after removal.
Resembles partent tissue.	Does not resemble parent tissue.
Usually does not cause death.	Can cause death if not treated early.

273. Define the etiology, signs, symptoms, and treatment of the alveolar osteitis.

Pathological Lesions. Pathological bone lesions are any lesions that affect the bone. We already have discussed many of these, such as inflammatory and developmental cysts, abscesses, and granulomas. A pathological bone lesion, which is frequently seen in the dent*al clinic, is alveolar osteitis* or "dry socket."

Alveolar osteitis is an extremely painful condition that results when a normal blood clot fails to form or is dislodged. Pain may occur immediately after the extraction or may be delayed for 2 or 3 days. Pain normally becomes increasingly acute after the third day and remains severe for several days without treatment or medication. Examination of the socket usually indicates that a portion of the alveolar bone is exposed and infected; hence, the name "dry socket." The socket usually has a pungent odor, and the surrounding tissue is inflammed.

Although the treatment of a dry socket may vary, it often consists of irrigating the socket with warm solution and packing the socket with iodoform gauze, saturated in eugenol. The gauze is packed tightly into the socket to provide sedative action without interfering with healing. Sedatives and/or analgesics may be prescribed to relieve pain and possible insomnia.

Exercises (273):

1. Under what conditions is alveolar osteitis likely to occur?

2. When does the pain from the alveolar osteitis become increasingly acute?

3. During alveolar osteitis, what does an examination of the socket usually reveal?

4. What treatment is used often to treat a dry socket?

274. Given a series of statements concerning traumatic bone lesions, determine which are true and which are false.

Traumatic Lesions. Fractures induced by trauma are perhaps the most common cause of traumatic lesions. Dental management of fractures deals primarily with the facial bones. Steps must be taken to heal fractures and restore the proper function. Fractures of the jaw and third molar extractions are the most common reasons for hospitalization of dental patients.

Other than the circumstances of emergency first aid, the dental assistant's primary involvement with facial fractures is in the capacity of an assistant to the dentist who is treating the patient. In order to identify the fact that a fracture exists, specific signs and symptoms are noticeable. Patients who exhibit the characteristics discussed below, should be considered fracture patients until determined otherwise.

Trauma. Wounds, swellings, and discoloration of the face, with a history of trauma to the site, should suggest the possibility that bones may be broken. Necessary precautions should be taken to prevent further injury. Bruising and the escape of blood from under the skin are indicative of blows that may be severe enough to break bones. Sometimes the broken bones can be seen or felt.

Pain. Pain, severe tenderness, and grating under the skin are good indications that a mobile bone fragment is present in that area.

Abnormal appearance. Facial asymmetry and luxation (discoloration) in which the normal appearance of the patient is changed, may indicate complete fractures. Diplopia (double vision) may occur if the bones forming the floor of the orbit are involved. Sunken areas or abnormal projections increase the suspicion of fractures.

Abnormal movement. Abnormal mandibular movements occur when muscles displace fragments of the bone fracture, or the continuity of the jaw is broken so that it does not swing from the tempromandibular joint but from the fracture site. The most noticeable movement indicative of a fracture is deviation of the jaw to one side or another when opening and closing the mouth.

Malocclusion. Malocclusion may be quite noticeable to the patient with a condylar fracture. The bite corresponds to the deviation of the mandible. Since the mandible swings toward the side of the fracture, the teeth usually strike on that side first when closing. Sometimes all of these signs and symptoms are present. Regardless of how many conditions are noticed, they should be noted and brought to the attention of the dentist, who will confirm the fracture with further examination and radiographs.

Exercises (274):

Identify each true statement and explain why the others are false.

____ 1. Traumatic lesions are actually fractures induced by trauma.

____ 2. Fractures of the jaw are the most common reasons for hospitalization of dental patients.

____ 3. A patient should never be considered as a fracture patient until the fracture has been verified positively.

____ 4. Bruising and the escape of blood under the skin are not generally indicative of blows severe enough to break bones.

____ 5. Pain, severe tenderness, and grating under the skin are good indications that a mobile bone fragment is present in that area.

____ 6. Diplopia (double vision) usually occurs with fractures of the body of the mandible.

____ 7. Facial asymmetary and luxation in which the normal appearance of the patient is changed indicate complete fractures.

____ 8. Malocclusion may be quite noticeable to the patient with a fractured jaw.

____ 9. The most noticeable movement indicative of a fracture is deviation of the jaw to one side when the patient opens or closes his or her mouth.

275. Name two classes of burns, identify their likely causes, and specify what precautions might prevent them.

Oral Lesions of Local Origin. Considering the number of functions performed by the mouth and associated structures, the mouth is an important part of the body. The oral cavity is abused with pencils, fingernails, caustic drugs, and hot and cold food. It often inflicts wounds upon itself with lip and cheek biting. All this abuse sometimes causes damage. The damage may be repairable, or it may cause permanent defects. Some of the agents of abuse can lead to serious problems and even loss of life. The most common oral lesions are discussed according to cause. Most of these problems can be avoided, since they are nearly all self-induced.

Thermal burns. Cases involving severe burns are rare in a dental clinic because the oral cavity is relatively inaccessible to heat hazards. The mucosa also has some built-in protection by virtue of its moist surface. Combat personnel occasionally receive flash burns, and a resultant severe sloughing of tissue occurs. Minor burns occasionally occur from hot foods on the labial and palatal mucosa. Most burns due to heat are unavoidable.

Burns may be caused by careless handling of heated dental instruments and materials. If an assistant uses instrument forceps to pass an instrument directly from a hot sterilizer to a doctor who is wearing rubber gloves, the patient may be injured before the doctor detects the temperature of the instrument. It also is likely that the patient will be anesthetized and therefore not be able to give a warning.

Careless manipulation of dental materials, such as impression waxes and endodontic instruments, constitutes a hazard. All such materials and instruments should be kept away from the patient and not brought to the operating area until they are within safe temperature range. Oral mucosa reacts the same to heat, regardless of the source—liquid, metal, or gas. The tissue protein of the mucosa coagulates and usually turns white and sloughs off, leaving an ugly raw wound that heals with difficulty and pain.

Chemical burns. The use of chemicals in dentistry is widespead. Many chemicals in the dental office are designed for use on the hard tissue of the teeth and are quite caustic in soft tissues. Handle these chemicals cautiously. Some of the common agents that cause chemical burns are given below.

Aspirin. Moisture changes acetylsalicylic acid into acetic acid and salicylic acid. Patients sometimes self-inflect chemical burns by placing an aspirin tablet in the mucobuccal fold next to a tooth which aches. This does not cure the toothache itself. The aspirin burn may be severe enough in some cases to expose bone and open a pathway for a painful infection. The mucosa turns white in the area covered by the tablet and usually sloughs off, leaving an ulcer that is difficult to treat. Question the patient to determine the cause of the lesion. To avoid being part of the problem, when aspirin is prescribed for a patient, emphasize that the tablet must be *swallowed* to give the beneficial effect intended.

Eugenol. This chemical is a refined oil of cloves and is quite useful in dentistry. Used properly, it is most beneficial, but it will burn soft tissue—although not as severely as aspirin.

Phenolic compounds. There are many compounds of phenol (carbolic acid) used in dentistry. Many of them have the same name but different strengths. They should be handled with extreme care, since they are very caustic.

Other caustics. Most dentists have a selection of compounds that are needed to support their operations. No attempt is made here to anticipate all of these requirements. Each dental assistant who handles caustics should follow the general instructions given below.

a. Know the contents of all the medicament bottles in the operatory.

b. Be able to describe the properties of these substances and the precautions necessary for handling, neutralizing, and storing them; for example, some require refrigeration, others, the absence of sunlight, etc.

c. Label all containers.

d. Make positive identification of all drugs and chemicals.

e. Be careful in handling all chemicals.

Exercises (275):

1. Name the two classes of burns.

2. Which class of burns may be caused by careless handling of heated dental instruments and materials?

3. How can you avoid thermal burns?

4. How do patients often receive self-inflicted chemical burns?

5. When aspirin is prescribed, what instructions should you give to the patient to avoid chemical burns?

6. Restate the instructions that should be adhered to by each dental assistant who handles caustics.

276. Name some oral manifestations of nutritional deficiencies.

Oral Manifestations of Nutritional Deficiencies. Oral lesions due to poor diet are relatively rare in the military patient. However, patients with diets that are deficient in one or more vitamins still frequent in the clinic. Most of these deficienices the patients complain of are due to the omission of certain foods from their diet because of habit or of personal taste. The avitaminosis (conditions due to the lack of specific vitamins) can produce acute problems in the oral cavity. For the dental assistant, it is a matter of recognition of abnormal texture and color. Nutritional disturbances are best managed by the medical facility. Only a brief representative group of these disturbances will be discussed.

Vitamin B complex deficiency. Several lesions can appear in the oral cavity from a diet deficient in this group of vitamins. *Angular cheilosis (ky-loe'-sis)* is the cracking of the corners of the mouth with accompanying pain due to irritation from foods and saliva. This condition must be differentiated from angular cheilitis, which is derived from to increased salivation or secondary infection of cracks in the corners of the mouth. Overclosure of the bite due to loss of vertical dimension by a person wearing dentures can be a factor contributing to cheilitis. Cheilitis is a lesion that results from local irritation, whereas cheilosis is due to vitamin B complex nutritional disturbance.

Prolonged deficiency of B-complex vitamins causes the tongue to enlarge, resulting in a glossy or smooth texture. The fiery red appearance also is due to insufficient vitamin B. Medical management usually recommends that patients increase their daily intake of the B-complex vitamin group.

Vitamin C deficiency. A prolonged vitamin C deficiency produces scurvy. This once common condition is now found only in patients with restricted diets. Unless the condition persists for a long period of time, the most significant oral manifestation of vitamin C deficiency is the impaired ability to heal and some gingival bleeding. Detectable changes in the periodontal structures supporting the teeth occur only after extended vitamin C deficiency. Treatment includes the administration of ascorbic acid (synthetic vitamin C).

Vitamin D deficiency. *Rickets,* a disease caused by a vitamin D deficiency, occurs mainly in rapidly growing children. As a result, a retarded eruption of teeth and an alteration in the order of eruption are seen often. Defects due to this nutritional deficiency result in hypoplastic areas, ranging from pits and grooves to the absence of enamel in some of the permanent teeth. The teeth most often affected are the permanent incisors, cuspids, and first molars. This disease is extremely rare in this country.

Exercises (276):

1. Match the descriptive statement in column A with the condition listed in column B. Items listed in column B may be used more than once.

Column A

____ (1) A prolonged deficiency produces scurvy.
____ (2) Deficiency may result in angular cheilosis with accompanying pain due to irritation.
____ (3) Treatment is the administration of ascorbic acid.
____ (4 Most significant oral manifestation is impaired healing ability and some gingival bleeding.
____ (5) A prolonged deficiency causes the tongue to enlarge and appear fiery red and glossy.
____ (6) Occurs mainly in rapidly growing children.
____ (7) Teeth most often affected are the permanent incisors, cuspids, and first molars.

Column B

a. Vitamin B complex deficiency.
b. Vitamin C deficiency.
c. Vitamin D deficiency.

CHAPTER 4

Dental Materials

THE SUCCESS of dental procedures depends upon the quality and handling of dental materials. Comingrom the manufacturer, these materials enter the Federal supply system and eventually end up in your dental clinic. There, the responsibility for using these materials rests upon you and your dental officer. While the dental officer has the overall responsibility, he or she/she relies upon you to properly prepare the materials. The dental officer looks upon you as a professional assistant. In addition, the dental officer expects you to have the knowledge and ability to proportion, mix, and assist with the placement of materials. A mistake in any one of these steps can mean the failure of the procedure.

The materials found in Air Force dental clinics are supplied by many manufacturers. All of these materials have been through many quality-control inspections to assure that they are of high quality. The American Dental Association (ADA) and Federal Government specifications set the standards for these materials. We can be reasonably sure that the dental materials arrive in Air Force dental clinics as high-quality products, but improper handling during shipment can alter a materials quality.

Although dental materials arrive as high-quality products, they are of little or no value unless they are handled properly. One way to improperly handle dental materials is to mix part of one material with a different lot number. We can compare this problem with a similar problem encountered with paint. Two cans of paint may have the same brand name, the same ingredients, and the same color listed on the label but have a different lot or batch number. The professional painter knows that it is next to impossible to obtain an exact color match with paints of different lot numbers. Further, there may be slight differences in the ingredient percentages that affect the drying (setting) time and the resultant texture. This same principle applies to intermixing dental materials that are alike except for their lot numbers.

Another way to improperly handle dental materials is to proportion and mix the amterial without following the manufacturer's instructions. We generally concede that the manufacturers know their materials best. Along with each unit (package, box, etc.), the manufacturer sends a small brochure that briefly explains the uses, mixing procedures, mixing time, setting time, and handling characteristics of the material involved. Therefore, it is important to read and follow the manufacturer's instructions. Let us first consider some of the demands placed on dental materials (demand factors), the physical structures of the materials, and their properties.

4-1. Demand Factors, Structure, and Properties of Dental Materials

The mouth is a harsh environment, subjecting dental materials to great forces, abrasion, temperature extremes, and corrosive conditions. In addition to having the ability to resist these conditions, the materials must: (a) be biologically compatible; (b) help protect the tooth and oral tissues; (c) be aesthetically pleasing; and (d) be easily formed and placed in the patient's mouth, despite limited access and poor visibility to restore natural contour and function.

277. From a list of statements, differentiate those that are true concerning the types of factors making demands on dental materials.

Factors Making Demands on Dental Materials. The following factors make demands on dental materials:

Biting forces. A person with natural dentition applies approximately 170 pounds (77 kilograms) of biting force in the posterior area of the mouth. This works out to reflect approximately 28,000 pounds of pressure per square inch on a single cusp of a molar tooth. Materials used in restoring chewing surfaces must have sufficient strength to withstand these forces.

Temperature changes. The temperature fluctuations within the mouth can be as great as 100° to 150° F within a matter of seconds such as when the individual is drinking hot coffee or eating ice cream. Restorative materials must be able to withstand such radical changes and, as nearly as possible, have the same rate of thermal conduction, expansion, and contraction as does the natural tooth structure.

Acidity. Acidity in the mouth varies greatly. Some foods, such as citrus fruits, are very acidic while others are quite alkaline. In addition, acid is liberated when bacteria act upon food debris present in the mouth. Thus, the surfaces of teeth and of dental restorations make constant contact with the corrosive effects of acid or alkaline substances. In such an environment, nonmetallic materials tend to deteriorate, and even metallic restorations will discolor and corrode.

Esthetic factors. Restorations must resemble the natural dentition as closely as possible. This demands color matching and color stability, in addition to materials that can be shaped to resemble teeth or be designed to be unnoticeable. Color stability is important because the restorations may be subjected to many substances that can stain. Chemical action within the oral environment may cause changes within the material itself which will result in discoloration.

Retention. Retention needs must be met within all of the physical and biological limitations imposed by the oral environment. Retention also is complicated because (1) the material must be nontoxic; (2) both organic and inorganic matter are involved; (3) the surfaces have imperfections, irregularities, and debris; and (4) the mouth has a normally wet atmosphere. These factors create a complex problem in trying to keep restorations firmly in place.

In trying to achieve mechanical retention, it also is necessary to take into consideration: (1) the differing rates of expansion and contraction of tooth structure and restorative materials; (2) the limited amount of tooth structure may safely be removed; and (3) the limited amount of stress that abutment teeth and oral tissues can withstand in trying to stabilize a fixed or removable denture. The biological limitations involved also are important.

Biological limitations. The biological characteristics of dental materials are closely related to their physical properties. Materials that possess ideal physical and chemical properties may be unsuitable if they also do not meet the biological limitations imposed by the oral cavity.

To meet the biological limitations, a material must be harmless to the individual and preserve or restore the health of the teeth and oral tissues. A substance that is potentially poisonous to the individual would not be suitable as a dental material despite the desirability of its other characteristics. Few dental materials are totally inert or completely harmless to the individual and the dental tissues. All materials must be used properly, following the appropriate precautions. Materials used in the mouth must not irritate the soft and hard tissues. Further, they should be neither mechanically nor chemically damaging, and they should cause no allergic or sensitizing effect.

Microleakage. One of the greatest deficiencies found in all the materials used in the restoration of carious lesions is that they do not actually seal the cavity preparation. A microscopic space always exists between the restoration and the tooth. This space permits microleakage, by which fluids, micro-organisms, and debris from the mouth may penetrate the outer margins of the restoration and progress down the walls of the cavity preparation through the dentin and into the pulp. With severe leakage, the pulp is irritated. This may cause the tooth to become sensitive or to redecay.

Temperature effects. Metal restorations rapidly conduct heat and cold. Within a matter of seconds the temperature at the floor of a large metal restoration can be the same as that at the surface. The layer of dentin that remains beneath the restoration may be so thin that it is inadequate to insulate the pulp against these sudden temperature changes. This inadequacy may cause injury to the pulp. In such instances, the dentist may provide additional thermal protection by placing a layer of suitable insulation under the restoration.

Tooth structure and restorative materials expand and contract at differing rates in response to temperature changes. This means that consideration must be given to finding a restorative material that will expand or contract at or close to the same rate as the tooth structure. Consideration also must be given to temperature changes produced by the chemical reactions that occur during the hardening of restorative materials after they have been inserted.

Galvanism. Another cause of tooth sensitivity is the small electrical currents created when two different metals are located close together in the oral cavity. Because both metals are wet with saliva, an action similar to that in a battery is created. When the two metals touch, an electrical current in the form of a small shock is created. A similar effect may occur when the edge of a silver fork touches a restoration.

Exercises (277):

Identify each true statement concerning the factors making demands on dental materials and explain why the others are false.

____ 1. The average biting force of a person with normal dentition is approximately 28,000 pounds per square inch on a single cusp of a molar tooth.

____ 2. Acids and alkaline substances in the mouth have no effect on metallic restorations.

____ 3. Color stability is important because the restoration may be subjected to many substances that will tend to stain them.

____ 4. Retention is complicated because materials must be toxic, organic matter is not involved, and the mouth has a normally dry atmosphere.

____ 5. The differing rates of expansion and contraction of tooth structure and restorative materials is due to temperature changes.

____ 6. The biological characteristics of dental materials are closely related to their physical properties.

____ 7. Dental materials are totally inert or completely harmless to the individual and to the dental tissues.

____ 8. A microscopic space exists between most restorations and the tooth they restore.

____ 9. It takes a few minutes for the temperature at the floor of a large metal restoration to be the same as that at the surface.

____ 10. Electrical currents can be created whenever two metals are present in the oral cavity.

278. Identify the structure and properties of dental materials by citing their basic physical and chemical properties.

The Structure and Properties of Dental Materials. In order to fully understand to the proper manipulation of dental materials and be able to predict how these materials will react under actual use, it is necessary to understand some of their basic physical and chemical properties. You also should know how these properties are measured and compared and be aware of how they affect the potential value of the material in relation to the many factors that make demands upon dental materials.

Force. Force is any push or pull upon matter. It can be a *tensile force,* that pulls and stretches a material, or a *compressive force,* that pushes it together, or it can be a *shearing force,* that tries to slice it apart.

Stress. This is the internal reaction or resistance within a body to any externally applied force. It is the reaction or resistance that occurs *within* a material when a force is applied from the outside. For stress to occur within a material, there *must* be an applied outside force. The greater the applied force, the greater the stress within the material.

When an applied force tends to stretch a material, tensile stress occurs. Heavy weight suspended from a metal wire creates tensile stress is created in the wire and it will increase in length. If the weight is placed on top of a material, a compressive force is established which, in turn, creates a compressive stress. The length of the specimen tends to decrease. When an applied force tends to slide one layer of a material past an adjacent layer, shearing stress is produced in the material. Scissors also are referred to as shears because they create a shearing stress in the material as one layer of the material is forced to shear past the adjacent layer.

Strain. Strain is the distortion or change produced in a body as the result of stress. The type of strain (distortion) depends upon the type of stress involved. Stress is the internal reaction to an external force and strain is the change caused by that stress. The greater the stress the greater the resulting strain. Each type of stress creates an accompanying type of strain. Tensile stress always is accompanied by tensile strain, compressive stress always is accompanied by compressive strain and shearing stress always is accompanied by shearing strain.

Elasticity. The abililty of a body that has been changed, deformed, or under stress to resume its original shape is termed "elasticity." An object that regains its original shape when stress is removed is elastic. A rubber band also is called an elastic band because it can be stretched (tensile stress), yet it returns to its original shape when you remove the stress. An object that remains permanently changed is inelastic. After compressive stress has been placed on a piece of soft butter, it will not return to its original form; therefore, it is inelastic.

The three terms *elastic limit,* proportional limit and *yield strength are* used interchangeably. They refer to the maximum stress that a structure or material can withstand without being permanently deformed. An elastic material that has been subjected to a stress that is above its elastic limit will not return to its original shape. A spring strained within its elastic limit returns to its original shape when the stess is removed; however, once you have strained the spring beyond its elastic limit, it will not return to it original shape. Knowledge of the elastic limits of dental materials is useful because such knowledge allows the dentist to estimate when a given stress will permanently change the shape of a dental restoration or appliance.

Ultimate strength. The greatest stress that a structure or material can withstand without fracture or rupture is known as its ultimate strength or, for the sake of brevity, its strength. If the stress and strains are tensile in type, the stress at fracture is called the *ultimate tensile strength.* If the stresses are compressive in character, then maximum stress is called the *ultimate compressive strength,* or crushing strength. The maximum *shearing* is called Ishearing or *shear strength.*

Ductility and malleability. Both ductility and malleability indicate the ability of a metal to be bent, contoured, or otherwise permanently deformed (reshaped). *Ductility* is the ability of a material to withstand permanent deformation under tensile stress without fracture. If a metal or alloy can be formed into a wire, i.e., shaped under tensile strain, it is ductile.

Malleability is the ability of a material to withstand permanent deformation under compressive stress without rupture. If a metal can be hammered or rolled into a sheet; i.e., shaped under compressive strain, it is malleable.

Flow. Some materials continue to deform permanently under a load, even when the load (stress) is constant. The slow bending of a glass rod under its own weight when it is supported at its two ends is an example of this. This change is called *flow.* It also may be referred to as *creep* or *slump.* In dental materials, flow generally is measured under compressive stress and has been used to evaluate the tendency of dental waxes or amalgam alloys to deform under a constant load.

Hardness. Surface hardness, for dental purposes, is generally measured in terms of its resistance to indentation. One scale used to measure hardness is the Brinell Hardness Number system. In performing the Brinell test, a small steel ball is pressed against the material to be tested and a predetermined compressive force is applied. After release of the load, the size of the indentation in the material is measured and the results are expressed in terms of the Brinell Hardness Number, which is usually abbreviated as BHN. The softer the material, the larger the indentation and the smaller the BHN number. The stronger the material, the smaller the indentation and the higher the BHN number.

Distortion. Whenever a substance is permanently deformed, there are stresses and strains present. These stresses cause internal rearrangement of the atomic structure of the material and leave it in a state of tension. With the passage of time, particularly in the presence of heat, the materials tend to relax and the tension is eased. The resulting change in shape or dimension is known as distortion.

The phenomenon of *relaxation* and the resulting distortion is very important in dentistry, since such dimensional changes may result in the misfit of a precise dental restoration or appliance. For example, dental waxes tend to relax at room temperature after being bent or molded. The resulting distortion can be very important to the dentists if they have used that wax to create a very precise inlay pattern.

Thermal properties. The ability of a material to conduct heat is known as its *thermal conductivity.* It is measured by determining the rate at which heat can be transmitted through a given cross-sectional area of a specimen of the material. The higher the rate value, the greater is the thermal conductivity.

Tooth structure itself is an excellent heat insulator and has a low thermal conductivity. Tooth restorative materials should have as low a thermal conductivity as possible; however, thermal conductivity is only one of many factors that must be taken into consideration. In constructing an artificial denture, a high rate of thermal conductivity is desirable, so the patient may have a normal sense of hot and cold while eating.

Thermal expansion is the rate at which a material expands or contracts with temperature changes. It is usually measured in terms of the linear coefficient of thermal expansion. This is the increase in length of a material per unit length when the temperature is increased by one degree centigrade. If the tooth and the restorative material expanded the same amount every time their temperatures changed, there would be little reason to consider thermal expansion. However, for the same temperature change, the linear coefficients of thermal expansion differ widely, and none of the materials expand or contract at exactly the same rate as the tooth structure.

Adhesion. Adhesion is the force that causes unlike molecules to attach to each other. Adhesion is the stickiness that allows tape or glue to stick. In order for adhesion to take place, the materials being joined must be in close contact. This is most often accomplished by applying the adhesive in the liquid state. The adhesive property of liquids involves the interplay of viscosity, wetting, film thickness, and surface tension.

Viscosity efers to the property of a liquid that causes it to not flow easily. An example of a viscous liquid is a thick or heavy syrup. A highly viscous adhesive will not flow easily and will not be as effective in wetting a surface as would an adhesive of lower viscosity.

Wetting is the characteristic of a liquid to flow easily over the surface and to come into contact with all of the small roughnesses that may be present. The wetting chracteristics of an adhesive are generally determined by measuring the angle formed by the adhesive when a drop of it is placed on the surface. This measurement is called the *contact angle*.

Water placed on a clean surface will flow freely and have a low contact angle with good wetting qualities. Water placed on a waxed surface will form drops, which have a high contact angle and poor wetting qualities. When a liquid has a low contact angle on a solid, the liquid is said to "wet" the solid well. The ideal adhesive would spread into such a thin film that the contact angle would be zero.

Film thickness refers to the thickness of the adhesive films, and this also affects the strength of the adhesive junction. Generally, the thinner the film, the stronger the adhesive junction.

Surface tension is related to the composition of the surface of the material, its atomic structure and other factors. The higher the surface tension, or surface energy, the more readily the adhesive reacts with it. Metals usually have a high surface tension and therefore are relatively easy to wet by a suitable adhesive. In contrast, Teflon has a very low surface energy and is used in situations in which sticking is not desirable.

Adhesion and tooth structure. Few conditions essential for adhesion are present in the oral cavity. Enamel and dentin are mixed in their composition, being partly organic and partly inorganic. An adhesive that will adhere to the organic component of the tooth will not be as likely to adhere to the inorganic portion. Thus, adhesion will occur only on isolated sites and will not be uniform over the entire surface. Also, it is difficult to design an adhesive capable of flowing into the minute imperfections and irregularities that mar the surface of the prepared cavity.

Of major importance is the presence of moisture. Even when a tooth appears dry, there is always a microscopic, single-molecule layer of water on the tooth surface. This layer prevents the adhesive from coming into intimate contact with the tooth. Other major factors include the differing rates of thermal expansion and contraction between tooth and restorative material and the mechanical stresses created during the pressure of mastication. Together these forces create a severe strain on any adhesive bond that may have been formed.

Exercises (278):

1. Briefly explain the three types of force that have an influence on dental material.

2. What must occur within a material to produce stress?

3. What is strain?

4. When a body is said to have elasticity, what properties does it exhibit?

5. What is ultimate strength?

6. What property does malleability give a material?

7. How is a material's hardness measured?

8. What change does flow cuse in a material?

9. What is thermal conductivity?

10. Briefly explain the adhesive action of liquids.

4-2. Metals in Dentistry

Metals are opaque, lustrous, crystalline solids which are conductors of heat and electricity and which, when polished, are good reflectors of light. Most metals are malleable and ductile. These unique characteristics allow them to be shaped into a variety of forms that cannot be easly constructed from nonmetallic materials.

The metals most commonly used in dentistry are *amalgam*, which is a combination of silver alloy and mercury used for dental restorations; *chromium-cobalt* casting alloy used for the cast frames of partial dentures, some denture bases and implants; and gold, which is used as a direct filling material for cast restorations and for wrought partial dentures. *Stainless steel* also is used for orthodontic bands and some crowns.

Most metals in dentistry are in the form of alloys. An *alloy* is a material that has the characteristics of metal and is composed of two or more elements, at least one of which is metal. The primary purpose of alloys is to modify the properties of the pure metal in order to provide special characteristics such as corrosion resistance and improved mechanical properties, including increased strength.

279. State the uses, characteristics, components, and properties of dental amalagam.

Dental Amalgam. Dental amalgam is the most widely used restorative material. It is the best material for many restorative procedures. To achieve the best possible results, the assistant must know how to properly mix and handle amalgam. Every step in the handling of amalgam, from proportioning of the alloy and mercury to the final polishing of the restoration, has some effect upon its properties. Often an amalgam that meets the American Dental Association (ADA) specifications may result in a very poor restoration because of some faulty technique in mixing. You must try, therefore, to set up a standard method of working with amalgam to eliminate any variation in any step of the manipulation.

Many dental clinics are now using precapsulated amalgam that greatly reduces the chances of an improper mix. However, other clinics are still using the technique of adding the mercury to the amalgam pellet before mixing.

Uses. Basically, dental amalgam has two uses. It is sometimes used as a die material in the dental laboratory. (In dentistry, a die is a positive reproduction of a tooth prepared to receive a restoration). More often, however, dental amalgam is used as a restorative material in the mouth. Usually, amalgam is limited to use in restoring posterior teeth because its color makes it esthetically undersirable in anterior teeth.

The composition of amalgam alloy. An alloy is the fusion of two or more metals. An amalgam is an alloy in which mercury is one of the metals. Dental amalgam restorations are made from metal alloy and mercury. ADA Specification No. 1 for the alloy of dental amalgam requires that it be composed of 65 percent silver, by weight; 29 percent tin, maximum weight; 6 percent copper, maximum weight; 2 percent zinc, maximum weight; and 3 percent mercury, maximum weight. The other ingredients are listed as maximum quantities and may be used in amounts less than those shown so that the total alloy equals 100 percent.

Silver is the main component of the alloy and imparts a high luster and a silver-colored appearance. It tends to increase strength, durability, and expansion as it decreases flow and setting time. A high percentage of silver causes an amalgam to expand excessively, tarnish easily, and amalgamate slowly.

Tin, the second major constituent, tends to reduce the expansion, strength, and hardness and to increase the flow, setting time, and workablity. Although it tends to weaken the amalgam, it is used to counterbalance the rapid hardening and high expansion properties of the silver.

Copper, within a limited range, tends to increase the hardness and expansion while decreasing the flow and setting time. Some available alloys increase the copper content above the traditional maximum of 6 percent. They are usually referred to as *high copper alloys*. They also may be called *low silver alloys* because the increase in copper is generally accomplished through a reduction in the amount of silver.

Zinc is used principally as a deoxidizer. It acts as a scavenger in uniting with oxygen and certain other impurities present. Amalgams containing an appreciable amount of zinc expand excessively and corrode badly if moisture is incorporated during mixing or packing. Not all alloys contain zinc. Those without it are called zinc-free or nonzinc alloys. When zinc is added, there will be a proportionate reduction in the tin or copper content.

Preamalgamated alloys are those alloys that contain a small percentage of mercury. Their advantage is that the presence of the mercury in the alloy provides more rapid amalgamation. Aside from this characteristic, these alloys have approximately the same working qualities as alloys of conventional composition. When mercury is included in the alloy, the percentages of tin, copper, or zinc may be proportionately reduced.

Mercury. Mercury is a metal in liquid form at room temperature. When mercury is placed in contact with certain other metals, it bonds the metals together. An example of this action is seen when mercury is placed on a silver coin. In a similar way, mercury reacts chemically with the particles of silver in the alloy to bond them together. To accelerate this chemical action, the alloy and mercury are usually placed in a capsule and mechanically triturated (mixed or thrown together). Mixing the amalgam will be discussed in more detail later. Now we will turn to some precautions involved in handling mercury.

Mercury left uncovered at room temperature volatilizes (converts into vapor) into the air. Since mercury vapors can be a health hazard, observe the following practices:

a. Store mercury in tightly sealed unbreakable containers. Do not store bulk mercury supplies or fill dispensers in carpeted areas.

b. Clean up any known mercury spill at once. There are several approved techniques for clean-up. For small spills, use vacuum aspiration through a water trap followed by a wet "HgX" (mercury vapor decontaminant) or calcium polysulfide treatment. HgX is available in a 16 ounce jar through NSN 6850-00-495-5506. Large spills on nonporous floor surfaces can be cleaned by using a commercial mercury vacuum system, following a decontaminating washdown.

c. Use precapsulated amalgam or a minimal mercury technique in proportioning the dental amalgam alloy. When using precapsulated amalgam, close the capsule after use before discarding to reduce mercury vapors.

d. Store amalgam scrap submerged in X-ray fixer or other recognized suppressant solution in a closed plastic container.

Notice that the label on a bottle of mercury shows the contents to be poisonous. Naturally, mercury in its pure state is harmful; but the mercury found in medicinal compounds and in dental amalgam is not harmful when properly applied.

Properties. The ideal restorative material would be one which would duplicate original tooth structures. Modern science has been unable to accomplish such a feat to date. Dental amalgam, however, does possess most of the desirable qualities.

Desirable properties are evidenced in a properly proportioned and properly mixed amalgam. It is easily adapted to a prepared cavity. It is dimensionally stable. It has adequate strength when set. It resists corrosion, and it has a suitable setting time.

Undesirable properties of dental amalgam include its high thermal conductivity and its poor color. Because of its high thermal conductivity, dental amalgam restorations are often placed over an insulating base material that helps to protect the tooth pulp from temperature-change irritation. The metallic or silver-gray color of dental amalgam also makes it undesirable as a restoration in anterior teeth. You can avoid adding other undesirable qualities by mixing the amalgam in correct proportions.

Exercises (279):

1. How can an amalgam meet the ADA's specifications, yet sometimes result in a very poor restoration?
2. What are the two basic uses of dental amalgam?
3. What is an alloy?
4. Cite the ingredients and their percentages that make up dental amalgam.
5. What does copper do in amalgam?
6. What are preamalgamated alloys?
7. Briefly explain mercury's role in dental amalgam.
8. List three desirable properties of amalgam.
9. List two undesirable properties of amalgam.

280. List alloy/mercury proportions and the setting reactions of dental amalgam.

Mixing Amalgam. Normally, dental amalgam is easily prepared. Very little equipment and time are needed to produce a satisfactory mix. However, you should understand how the alloy/mercury ratio affects the amalgam produced.

Alloy/mercury ratios. The proportions of mercury and alloy used in the amalgam mix may be described as the mercury/alloy ratio or as its reciprocal, the alloy/mercury ratio. Consult the manfacturer's directions about the correct ratio to use with any particular brand of alloy. The ratio may vary for different alloys and for the particular technique desired by the dentist. With small-grained alloys, the mercury/alloy ratios of 6.5 or 1:1 generally are preferred. The 1:1 ratio is known as *the minimal mercury technique*. With spherical alloys, an even lower mercury/alloy may be used.

A low mercury/alloy ratio is desirable to achieve maximum amalgam strength. In *excess mercury techniques*, which require a high mercury/alloy ratio for mixing, the excess mercury must be removed by "squeezing" prior to placement and "expressed" by condensation during placement. Such techniques are inconsistent in their results and are not in keeping with the principles of proper mercury hygiene. An advantage of the minimal mercury/alloy ratios is that it is not necessary to remove excess mercury. Thus, this technique standardizes and uniformly produces more satisfactory results.

Setting reactions. The first thing that occurs during trituration (the mixing together of the mercury and alloy) is the combining of the mercury and the alloy particles. Since this absorption decreases the total volume, an initially small contraction takes place. This happens during the first hour after the mixing.

Immediately afterward, an expansion takes place as crystals of a silver-mercury compound and a tin-mercury compound form. The two compounds are referred to as the *gamma-one* and *gamma-two* phases, respectively. These crystals exert a pressure as they interlace and meet while the amalgam hardens.

After approximately 6 or 7 hours, this crystallization is completed. A second very slight contraction occurs as more of the free mercury, which still remains, is taken up by the remaining original particles of the alloy.

Dimensional changes are to be expected and, within a limited range of ± 20 micrometers per centimeter, are acceptable under the ADA specification. The composition and constitution of the amalgam affect its dimensional change during hardening; however, dimensional change can be influenced markedly by improper trituration, manipulation, or condensation. After the restoration is inserted, dimensional change in it should be at a minimum. Any excessive expansion can lead to pressure and postoperative sensitivity in the tooth or to a protrusion of the restoration from the cavity. Likewise, if contraction is severe, the restoration conceivably could pull away from the cavity walls and permit gross leakage between the tooth and the restoration.

Strength is most important in an amalgam restoration. The restoration in a tooth is subject to compressive, shearing and tensile stresses. A lack of truly adequate strength to resist mastication forces has long been recognized as a weakness of the amalgam restoration. A study showed that about 26 percent of the failure of clinical amalgam restorations were due to fracture. Fracture, even on a small area, and deterioration of exposed margins will hasten the recurrence of decay and subsequent clinical failure.

Exercises (280):

1. What should be consulted in regard to the correct ratio one should use with any particular brand of alloy?

2. What is the minimal mercury technique?

3. Why is a low mercury/alloy ratio desirable?

4. What is the first phenomenon that occurs during trituration?

5. What improper techniques can influence markedly dimensional change?

6. Why is strength important in an amalgam restoration?

281. Specify procedures that ensure an adequate quality control in dental amalgam preparation.

Quality Control Measures. To assure high-quality amalgam restorations, quality control measures must be continually applied. The control measures must begin with the development of the amalgam materials and end only after a prepared part of a tooth has been restored successfully. Quality control measures are divided along three lines of responsibility: the first control measures are the responsiblity of the manufacturer; the second, the dental assistant; and the third, the dentist himself.

Manufacturer control measures. The manufacturers are responsible for the purity of the ingredients in their products. With reference to amalgam alloy specifically, the manufacturer must exercise proper controls to produce an alloy with the metals in the correct proportions. We depend upon the manufacturer to provide an alloy with the proper particle size, since the particle size affects the consistency of the mix for a given alloy-mercury ratio. Another process controlled by the manufacturer is the heat treatment given to the alloy metals. This is the controlled heating and cooling of the metals to bring out the best combination of the strength, condensing ability, and chemical bonding ability of the alloy.

Assistant control measures. Although the dental officer has the overall responsibility for any restoration, you have the responsibility to exercise certain control measures in handling dental amalgam. Among the areas under your control are the proportioning, mixing, and manipulating of the amalgam.

a. Proportioning. Proportioning of the amalgam can be vital to the success or failure of the restoration. This is especially true when there is too little mercury, which produces a "dry mix." If any portion of a mix is too dry, it should be replaced with a mix of proper consistency. You should never add mercury to a mix that is too dry. If 1 drop of mercury is added to a partially set mix of average size, the resulting compressive strength of the mix will be about one-tenth of the normal strength.

In addition to knowing the alloy-mercury ratio, you also must know the proper amount to mix. Because some Air Force dental clinics use the pellet type of silver alloy, the amount to be mixed is stated in numbers of pellets. You may be asked to mix a "2-pellet mix." This means that you should place 2 silver alloy pellets in the mixing capsule and add the amount of mercury the manufacturer recommends to reach the proper alloy-mercury ratio.

There are two methods of proportioning the mercury. In the "manual" method, because pellets are preformed with a set amount of silver alloy, you must measure the mercury by using an eyedropper and counting the drops. However, a faster and more accurate method is to use a mercury disperser, made specially for this purpose. This dispenser unit, shown in figure 4-1, comes with four interchangeable plungers, each of which dispenses a specific quantity of mercury when you depress the plunger. You can vary the alloy-mercury ratio by interchanging the plungers. You can operate the device by placing the required number of alloy pellets in the mixing vessel. Then you can add mercury by depressing the plunger on the mercury container the proper

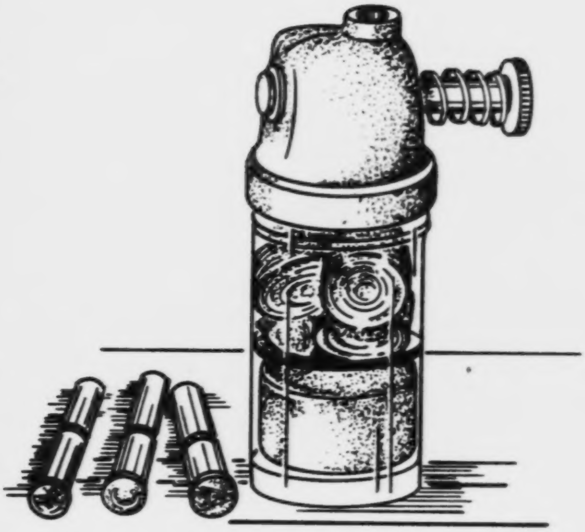


Figure 4-1. Mercury dispenser.

number of times. Be sure to use the plunger that produces the desired mix consistency. The manufacture of the alloy pellets will state the appropriate plunger.

b. Mixing. Mixing the amalgam properly also is vital to producing a quality restoration. Some improper quality control measures are faulty timing, overtrituration, and under trituration.

(1) Timing is important as it relates to the moment when the mixing process should begin. If you begin a mix too soon, the amalgam may begin to set prematurely. Ask the dental officer to notify you when the mix will be ready.

(2) Overtrituration is undesirable because it decreases the setting time and increases the shrinkage of the amalgam.

(3) Undertrituration also is undesirable because it increases the setting time, increases the expansion, and weakens the amalgam. Once again, to prevent overtrituration or undertrituration of amalgam, consult the manufacturer's instructions.

c. Manipulation errors. As the dental assistant, your manipulation of amalgam is important. If proper controls are not exercised, the results can mean discomfort and inconvenience for the dental patient. The most common error in manipulating amalgam is contaminating the mix with moisture or other impurities. These contaminants usually are introduced during the mixing or mulling of the amalgam.

(1) Moisture. If moisture in any form contacts freshly triturated amalgam, the result can be painful and injurious to the dental patient. The undesirable effects cause delayed and excessive expansion, lowered crushing strength, blister formation on the amalgam surface, and pain shortly after the filling is inserted. You can introduce moisture into amalgam by mulling it in a moist palm, touching or handling it with moist fingers, or triturating it at a temperature below the dewpoint (the temperature at which moisture from the atmosphere begins to form on an item). Storing amalgam in a cold storeroom and then bringing it into a warm room would be an example of the temperature being below the dewpoint. On the other hand, you can help control the introduction of moisture into amalgam by making sure that it does not directly touch your bare skin and by assuring that the temperature of the amalgam does not fall below the dewpoint.

(2) Other contaminants. Any foreign materials that enter the amalgam are contaminants. If soil from an unclean squeeze cloth or debris on an instrument is introduced into an amalgam, it can interfere with the chemical bonding action. Even a small fragment of amalgam lodged in a capsule can act as foreign matter. To remove a small fragment of lodged amalgam, place a couple of drops of mercury in the capsule and place it on the amalgamator for a few seconds. This process usually dislodges the fragment of amalgam, and it can then be emptied with the rest of the contents into the scrap amalgam container. To prevent contaminating amalgam with foreign matter, make sure that you use only clean instruments and capsules.

Dental officer control measures. The dental officer has the sole responsibility for condensing the amalgam. If he or she does not condense the amalgam sufficiently, the results can be an increase in expansion and therefore a weakened amalgam. Further, the chemical setting action can be interrupted if the dental officer takes too long in condensing the amalgam. This interference also weakens the amalgam. We mention these possible problems in condensing amalgam only because the dental officer condenses the amalgam that you prepare. Therefore, condensing problems encountered by the dental officer may be the result of improper action on your part. As you may have already concluded, teamwork is essential in handling dental amalgam.

Exercises (281):

1. Who is responsible for the purity of ingredients, correct proportions of metals, proper particle size, and the heat treatment of the silver alloy?

2. What should you do if your amalgam mixture is too dry? Why?

3. Why is overtrituration or undertrituration of an amalgam undesirable?

4. What is the most common error in manipulating amalgam?

5. List the undesirable effects caused by moisture contamination of amalgam.

6. List three ways that moisture can be introduced into amalgam.

7. How can you eliminate small fragments of amalgam that have lodged in the capsule from a previous mix?

282. State the uses, characteristics, and properties of cast chromium-containing alloys.

Chromium-Cobalt Casting Alloy. Alloys of chromium-cobalt and chromium-nickel which contain approximately 20 to 30 percent chromium have been used for over 40 years in dentistry. They are used for applications such as denture bases, partial denture frameworks, occasionally for certain types of bridgework, dental implants and for orthopedic surgery implants throughout the body.

When properly finished and polished, these chromium-containing alloys are silver-white and lustrous in color and appearance. The advantages of using these alloys for dental castings are that they are lighter in weight, have an excellent resistance to corrosion, have good mechanical properties, and are less expensive than the gold alloys. Their one disadvantage is that they require specialized equipment and techniques, which restricts their fabrication almost entirely to an area dental laboratory.

Exercises (282):

1. How are chromium-containing alloys used in dentistry?

2. When properly finished, what appearance does an alloy containing chromium have?

3. What are the advantages of chromium alloys for dental castings?

4. What are the disadvantages of chromium alloys for dental castings?

283. State the uses, characteristics, components, and properties of dental golds.

Dental Golds. Gold has been used for centuries as a dental restorative material. It was used quite early as a relatively pure metal in wire or sheet form, but not it is is alloyed with other metals and serves many useful dental purposes. No metal, or combination of metals, serves dentistry in such wide ranges of applications as does gold and its several types of alloys. As with all restorative materials, the quality of gold restorations depends on a combination of manipulative procedures and physical or mechanical properties.

Gold is a soft, malleable, ductile metal which does not oxidize under atmospheric conditions and is attacked by only a few of the more powerful oxidizing agents. It has a rich, yellow color with a strong metallic luster. Pure gold is nearly as soft as lead. In dental applications and in the making of coins and articles of jewelry, it must be alloyed with copper, silver, platinum, or other metals. This develops the hardness, durability, and elasticity necessary for lasting restorations.

Direct filling gold. Pure gold is the most malleable of metals and may be rolled into very thin sheets. These sheets can be further thinned to the point that light can be transmitted through the metal. In this condition it is known as *foil*. When the surface of the foil is absolutely clean, two pieces may be welded together by simply bringing them into contact.

Pure gold can be supplied in forms other than foil. A fine gold powder may be compressed and heated to a temperature just below the melting point of the metal. The compact mass, referred to as mat foil, is then supplied in small, thin strips.

More recently, pure gold has been provided in the form of a powder. Small particles of gold are lightly compressed into a pellet ranging in size from approximately 1 to 3 millimeters. Each pellet then is wrapped in gold foil. In terms of physical properties, there is no evidence of a superiority of one particular form of direct-filling gold over another.

Dental casting gold alloys. Casting gold alloys used in dentistry are made up of gold, silver, and copper modified with platinum, palladium, and zinc. In ADA Specification No. 5 for dental casting gold alloy, the following types are specified:

Type I soft—those subject to very slight stress and in areas where burnishing is desired. Their composition is limited to gold, silver, copper, and zinc.

Type II medium—those subject to moderate stress such as three-quarter crowns,, abutments, pontics, full crowns and saddles. Alloys in this hardness range may contain a small amount of palladium or platinum.

Type III hard—those subject to high stress such as *thin* three-quarter crowns, *thin* cast backings, abutments, pontics, full crowns, and saddles. Since they are necessarily stronger, these alloys usually contain more palladium or platinum than do the other types.

Type IV extra hard—those thin in cross-section and subject to very high stress such as saddles, bars, clasps, crowns, and unit castings.

222

Wrought gold. Gold alloys which are worked and adapted into prefabricated forms for use in dental restorations are described as wrought gold alloys. These forms may include plate and band material, fabricated bars, backings for artifical teeth, and wire in various cross-sectional shapes for use as clasps on prosthetic appliances, as well as various types of orthodontic appliances. Wrought stainless steel, nickel-chromium alloys and cobalt-chromium alloys have largely displaced the gold-base alloys in orthodontic and most other uses.

Porcelain fused to alloy. When skillfully fabricated, esthetically pleasing restorations that withstand the stress of mastication can be obtained with porcelain-fused-to-metal techniques. In this technique, a thin metal "thimble" for the crown, pontic, or other structure is cast. The porcelain is then fused as a veneer onto the metal crown so that little or no metal is visible. A layer of opaque porcelain is fused against the casting, and then the tooth contour is built up by fusing an overlay of translucent material. The finished veneered crown is then cemented on the prepared tooth in the usual manner.

The alloys most commonly used with porcelain are gold-based and may contain up to 15 percent platinum and palladium. Small amounts of base metals, such as indium and tin, are included in order to produce a thin oxide surface film that can provide a means for chemical bonding of the metal to the porcelain.

Porcelain used for artificial teeth has a low coefficient of thermal expansion when compared to gold. The porcelain used in combination with metal must have a coefficient of thermal expansion very close to that of the metal on which it is fired. The match of thermal coefficients is necessary to minimize the possibility of fracture of the porcelain during cooling from the firing temperature.

Exercises (283):

1. What characteristics of gold make it a desirable restorative material?

2. What is the composition of the casting gold alloys used in dentistry?

3. Define Type I gold.

4. Define Type IV gold.

5. State the steps in the porcelain fused-to-metal technique.

4-3. Composite Filling Materials

Composite restorative materials now are the material of choice for some restorations. Like the other restorative materials, they have both desirable and undesirable properties. The composite restorative materials are available from many different manufacturers. Some brand name examples are Adaptic, Addent, Concise, and Dakor. Each of these materials is different from the others and therefore requires special handling. For this reason we will not cover the mixing procedures for composite filling materials. You should be thoroughly familiar with the manufacturer's instructions for the composite restorative material used in your clinic.

284. State the uses and components of composite filling materials, and identify their properties.

Uses. Composite restorative materials are used primarily for anterior restorative procedures. Because of their increased crushing strength, they are very suitable for incisal restorations.

Components. Basically, all composite restorative material kits consist of composite material and a catalyst. The exact ingredients of the various composite materials and their catalysts remain closely closely guarded secrets of their manufacturer. Composite materials consist of organic binders and inorganic fillers. The function of the binders, as their name implies, is to bind the mix during setting. These binders are modified acrylates that become highly crosslinked during setting. The inorganic fillers comprise the bulk (probably 70 percent) of the composite material. Various inorganic materials are associated with the fillers of the different manufacturers. Some of these fillers are fiberglass, natural quartz, glass beads, and other translucent spherical fibrous and powdered mineral fillers. These fillers provide a light transmission system for adapting the color of the composite material to the surrounding tooth structure. The composite material usually is supplied in paste form. Depending on the manufacturer, the composite material comes in jars, tubes, or individual units. The catalyst is the agent that, when mixed with the composite material, causes it to set or harden. These catalysts, depending on their manufacturer, are supplied in either paste or liquid form.

Combined Properties. As stated earlier, composite filling materials have both desirable and undesirable properties.

Desirable properties. The desirable properties of composite filling materials are many. They closely resemble the natural tooth structure and are translucent. The marginal shrinkage of composite fillings is minimal. This factor reduces the possibility of marginal leakage and recurring caries. The composite fillings are resistant to water absorption and solubility which reduce their susceptibility to washing out. They resist staining and abrasion by being strong and hard. Because of their strength, the composites are used for incisal restorations. Probably the most interesting desirable property of this material is its ability to assume the color of the natural tooth.

Undesirable properties. Primarily the composite filling material has two undesirable properties. As you recall, the composite restorative materials do not have an anticariogenic property, even though they display little marginal shrinkage and a low incidence of recurring caries. The second undesirable property is the extremely short shelf life of most composite resins. Some composites have such a brief shelf life that the manufacturer's instructions call for the materials to be destroyed 30 days after they have been opened. But if left unopened, most of the composites can be safely stored for several months; and if refrigerated, their shelf life can be extended further.

Placement Procedures. The placement procedures used with composite filling materials are relatively uncomplicated. The dentist uses the clear plastic matrix strip partially to form and hold the composite in place until the initial set is complete. The composite material is condensed into the cavity preparation with a stellate plastic restorative plugger or a special syringe. After the material is set, the dental officer trims and smooths it until it assumes the contour of the natural tooth. The dental officer then places a protective coating over the restoration to protect it from premature exposure to oral fluids.

Acid Etch Technique. One of the most effective methods of improving the seal and retention of resin to the cavity walls is treatment of the enamel with an acid prior to insertion of the resin. This procedure, referred to as the acid etch technique, utilizes a solution of 35 to 50 percent phosphoric acid. The resin penetrates into the surface irregularities created by the acid and forms resin "tags" that mechanically interlock the resin with the enamel surface. Handle the etchant with care, since it is caustic.

Light Technique. There are several composite materials available today that rely on a light source instead of a chemical reaction to achieve proper polymerization. Nuva system is one example which uses ultraviolet light. Prisma is a system that uses visible light through a fiberoptic bundle. These materials are handled and prepared much the same as other composite materials, however, smaller portions are placed in the cavity preparation and exposed to the light source, which results in polymerization.

Exercises (284):

1. In what teeth are composite filling materials primarily used? Why?

2. Name the basic components of a composite filling material set.

3. Name the basic ingredients and specify the function of the composite filling material's organic binders and inorganic fillers.

4. In what form are composite restorative materials usually supplied?

5. What is the function of the composite filling material's catalyst?

6. Identify the desirable and undesirable properties by indicating which of the following properties apply to composite restorative material. Indicate those that apply by placing an "X" in the spaces provided.

____ a. Resembles tooth structure.
____ b. Is translucent.
____ c. Provides anticariogenic action.
____ d. Is water soluble.
____ e. Has a long shelf life.
____ f. Not susceptible to washing out.
____ g. Resists abrasion.
____ h. Suitable for incisal restorations.
____ i. Highly susceptible to marginal leakage.
____ j. Resists staining.
____ k. Assumes the natural tooth's color.

7. Briefly explain the acid etch technique.

8. How does the visible light technique differ from that for regular composite materials as far as polymerization is concerned?

4-4. Dental Cements

Dental cements are widely used for specialized dental services when strength is not a prime consideration. Regardless of certain inferior properties, cements possess so many desirable characteristics that they are used in 40 to 60 percent of all restorations. Dental cements are used as:

a. Cementing agents for fixed restorations such as crowns, bridges and inlays. This includes both temporary and permanent cementation.

b. Cementing agents for orthodontic bands.

c. Insulating bases to protect against thermal shock under metallic restorations.

d. Temporary restorations; i.e., those with a limited life span.

e. Sedative treatment.

f. Capping materials for an exposed pulp or to protect the pulp.

g. Root canal fillings.

Cements, although widely used, are in general far from ideal. They are soft and weak in comparison to metals. With the exception of resin cements, they dissolve and erode in the mouth. Except for polycarboxylate cements, they are not adhesive to enamel and dentin under oral conditions. Cements, except zinc oxide-eugenol and polycarboxylate, may be irritating to the dental pulp.

The physical properties of these materials vary considerably from one type to the next; however, in all cases, these properties are controlled almost entirely by the mixing technique.

285. List the uses of zinc phosphate cement, state mixing procedures for zinc phosphate cement, and identify its properties.

Zinc Phosphate Cement. In recent years, numerous new dental materials have been introduced to the dental profession. Many of these new materials have been widely accepted and generally have replaced many of the older materials. Although zinc phosphate cement is among the older dental materials, it still is widely used. One reason for its continued use is its wide applicability.

Uses. Zinc phosphate cement is used as a cementing agent for crowns, inlays, fixed partial dentures, and other dental appliances. It also is used as a temporary restoration and occasionally as an insulating base under amalgam fillings.

Components. Zinc phosphate cement is composed of a powder and liquid. Each component is packaged in a small bottle. The two bottles arrive in the dental clinic in a small box. When you open the zinc phosphate cement box, you will find a small corkscrew and a dropper in addition to the two bottles. After you have fitted the rubber part of the dropper into the opening provided in the lid of the bottle, use the corkscrew to remove the stopper from the bottle containing the liquid and close the bottle with the plastic lid. This helps to keep humidity out of the liquid.

Powder. The exact ingredients of zinc phosphate powder vary from manufacturer to manufacturer, but the chief ingredient in all brands of the powder is zinc oxide. In some instances, the powder also contains magnesium oxide, silica, bismuth, trioxide, and certain pigments. The different pigments, of course, produce different shades of powder. Air Force dental clinics primarily use light gray and light yellow shades. If you have any doubt about the shade you should mix, ask the dental officer. Now let us consider the liquid component.

Liquid. The liquid used with zinc phosphate cement powder is composed of phosphoric acid and water. Zinc phosphate cement liquid may also contain aluminum hydroxide and zinc hydroxide. When the liquid and powder are mixed, the phosphoric acid combines with the zinc oxide to form zinc phosphate. The manufacturer adjusts the water content to provide a suitable setting time. Too much water in the liquid causes the mix to set rapidly, while too little water causes it to set slowly. Mixing the powder and liquid yields certain properties that we call combined properties.

Combined properties. Zinc phosphate cement in its combined state possesses some desirable and some undesirable properties. In this respect, it is like amalgam. However, the properties of zinc phosphate cement make it more suitable as a cementing agent than as a restorative material.

Desirable properties. The shades of zinc phosphate cement allow it to be used inconspicuously. The cement is fairly easily mixed and is easily manipulated after mixing. It can be mixed and used in a thin consistency, which gives the cement sufficient flow to form a very thin layer for cementing crowns, inlays, and fixed partial dentures. Zinc phosphate cement is also desirable because it has low thermal conductivity. For this reason it is used under metallic restorations as an insulator to protect the pulp from the rapid temperature changes that are characteristic of metal restorations.

Undesirable properties. Probably the most significant clinical property of zinc phosphate cement is its solubility and disintegration in the oral environment. Cement solubility can lead to recurrent decay (caries) around crowns and inlays. Cement is also used as an intermediary base for deep cavity preparations and as a cementing agent for crowns, inlays, etc. The acidity of the cement irritates the tooth pulp. The relatively low crushing strength of the cement is also undesirable. The crushing strength of a zinc phosphate cement mix of medium consistency is about 12,000 pounds per square inch. The strength of the mix is directly proportional to the amount of powder it contains. Therefore, mix the maximum amount of powder that still yields the desired mix consistency. Zinc phosphate cement shrinks during setting, which is also undesirable. All of these undesirable properties influence its use. It is still, however, universally accepted and used as one of the basic dental materials. As with amalgam, the method of mixing zinc phosphate cement is very important.

Mixing procedure. The best source of information on the proper mixing procedures is the manufacturer's instructions. Generally, the steps include equipment preparation, materials preparation, and the approved mixing technique.

Equipment preparation. You need the following items of equipment to mix zinc phosphate cement:

a. A clean, cool, dry glass slab.

b. A clean, cool, dry spatula. Spatulas designed for mixing zinc phosphate cement are the #313 and #324 stainless steel types. The above items may need cooling under cold running water before they are used. Thoroughly dry them before the actual mixing. The temperature of the mixing slab and spatula affects the setting time of the mix. Cooler slab and spatula reduce the setting time.

Material preparation. When the dental officer indicates that zinc phosphate cement will be used, select a matching set of powder and liquid and measure out the powder. To do this, remove the cap and roll the neck of the powder bottle on the glass slab until you have dispensed from 1/6 to 1/4 of a teaspoon of powder. The amount of powder depends upon the type of mix desired. (We shall cover this topic later.) The powder is then divided into portions—generally fourths. Then one of the fourth portions is divided in half, and sometimes one of the eighth portions is divided into halves again. This division yields a total of 6 portions—3 one-fourth portions, one-eighth portion, and 2 one-sixteenth portions. Wait until the dental officer is ready for you to mix the material before you measure out the liquid. Exposing the liquid to air prematurely can affect the water content and in turn affect the setting time of the cement. With the signal to mix, dispense from 3 to 5 drops of liquid and then begin the mixing procedure. (The amount of powder dispensed governs the amount of liquid needed.)

There are two types of zinc phosphate cement mixes. The first mix has a thin, medium consistency. It is used as a cementing agent for inlays, crowns, and other dental appliances. The second type is a thick mix, which is used as a base material under fillings and sometimes as a temporary filling.

Mixing technique. The thickness of the zinc phosphate cement mix depends largely upon the amount of powder incorporated. For a cementing-type mix, incorporate one of the sixteenth portions and spatulate them over a large portion of the slab; then follow the same pattern with the next sixteenth portion, the eighth portion, and so on until the desired consistency is reached. A thin-to-medium mix should be completed in approximately 1½ minutes. The consistency of the mix should appear somewhat creamy and flow from the spatula. To prepare a thick mix, add more powder and complete the mix within 1¾ minutes to 2 minutes. Be sure the mix is homogeneous (of uniform consistency). Always mix zinc phosphate cement over a large area of the slab. This cement dissipates the heat created by the chemical action of the ingredients. If the heat is not dissipated, it will injure the tooth pulp and cause a faster setting.

Several factors influence the setting time (working time) of zinc phosphate cement. The following factors shorten the setting time:

a. A warm mixing slab and spatula.
b. A moist mixing slab.
c. Rapid mixing.
d. Dilution of the liquid with moisture from the air.

The following factors prolong setting time:

a. A cool, dry slab.
b. Evaporation of water from the liquid.
c. Mixing over a large area of the slab and slow spatulation.

Exercises (285):

1. List two uses of zinc phosphate cement.

2. What is the chief ingredient the zinc phosphate cement powder?

3. From the properties stated below, list those that apply to zinc phosphate cement by placing an "X" in the space provided.

____ a. Insoluble in oral fluids.
____ b. Shrinks during setting.
____ c. Irritating to tooth pulp.
____ d. Easily mixed and manipulated.
____ e. Has a high thermal conductivity.
____ f. Can be used in thick or thin consistency.

4. What equipment should you use for mixing zinc phosphate cement?

5. What is the mixing time for a thin-to-medium mix of zinc phosphate cement?

6. What is the mixing time for a thick mix of zinc phosphate cement?

7. Why is it important to mix zinc phosphate cement over a large area of the slab?

8. Indicate the factors that prolong the setting time of zinc phosphate cement by placing an "X" in the appropriate spaces.

____ a. Water evaporation from liquid.
____ b. Cool slab.
____ c. Rapid mixing.
____ d. Warm slab.
____ e. Slow spatulation.
____ f. Dilution of the liquid by moisture.
____ g. Mixing over a large area of the slab.

286. Given a list of dental cements, identify each by its properties, characteristics, and use.

Zinc Oxide-Eugenol Cements. The zinc oxide-eugenol cements (ZOE cements) are probably the most effective materials used as temporary fillings before a permanent restoration is placed in the mouth. The eugenol exerts a palliative (soothing) effect on the pulp of the tooth. Zinc oxide-eugenol cement is not used as a permanent restorative material because it has a very low crushing strength (2500 psi). ZOE cements are also good thermal insulators and may be one of the least irritating of any of the dental cements. They are used as temporary fillings, as thermal insulating bases, and as root canal fillings.

In an effort to reduce postoperative sensitivity while the pulp heals, fixed bridges are frequently cemented temporarily with zinc oxide-eugenol cements. Because of the relative strength of this type of cement, the bridge is later cemented permanently with zinc phosphate cement.

The zinc oxide-eugenol cements are usually dispensed in either liquid or powder form. Their composition is essentially the same as that of the impression pastes, except that no plasticizers (used to keep a material soft or pliable) are introduced. A satisfactory ZOE cement can be made with just zinc oxide and eugenol. However, the working properties of the cements can be improved by additives.

Resin acts to improve the cement's consistency and provide smoother mixing. The addition of plastics such as polymethyl (methacrylate) and polystyrene increases the strength.

EBA Cements. The improvement in properties that can be attained through the use of additives has led to the formulation of improved or reinforced zinc oxide-eugenol cements. The addition of ortho-ethoxybenzoic acid to the eugenol and quartz or alumina as a filler to the powder results in a composition often referred to as EBA cements. The strength and solubility of EBA cements are not superior to those of the zinc phosphate cements. They also are are not irritating to the pulp and help to eliminate or greatly reduce the postoperative sensitivity associated with zinc phosphate cementation of a restoration.

Zinc Silicophosphate Cements. These cements are used as cementing mediums and as temporary restorations for posterior teeth. They are a combination of silicate cement powder and a powder of zinc oxide and magnesium oxide. The composition of the liquid is generally comparable to that of silicate cement liquids. Thus, the resulting set cement is somewhat a hybrid of silicate and zinc phosphate cements.

This type of cement is stronger than zinc phosphate cement when used as a cementing agent, but generally inferior in of film thickness and working time. Its use as a cementing agent has been primarily limited to orthodontic appliances and, even there, it has largely been replaced by the polycarboxylate cements. Because the zinc siliophosphate cement does have greater translucency than zinc phosphate cement, it is used for cementation of porcelain restorations when the color of the cement could affect the color of the restoration.

Resin Cements. Resin cements based primarily on poly (methyl methacrylate) with mineral fillers have been available since 1952. They have not found wide acceptance, mainly because of their short working time and the difficulty of removing excess hardened cement from interproximal spaces and from beneath the free gingival margin. Their principal advantage is that they are virtually insoluble in water.

Polycarboxylate Cements. Polycarboxylate is one of the newest dental cement systems and the only one for which there is evidence of adhesion to tooth structure. They are powder-liquid systems in which the liquid is a viscous (thick) aqueous solution of polyacrylic acid and water. The powder is principally composed of zinc oxide with some magnesium oxide. It may also contain small quantities of calcium hydroxide, fluorides and other salts which modify the setting time and enhanced the manipulative characteristics. The compressive strength of the polycarboxylate cement falls into the range of the reinforced zinc oxide-eugenol cements but is inferior to that of zinc phosphate cements. The solubility of the carboxylate cements is comparable to that of zinc phosphate and the reinforced zinc oxide-eugenol cements.

Gutta-Percha. Gutta-percha is a thermoplastic natural gum. It is sometimes referred to as "temporary stopping" because at one time it was widely used for this purpose. Today gutta-percha is used primarily to fill the root canals of teeth during endodontic procedures.

Exercises (286):

1. Match the dental cements listed in column A with their correct description listed in column B. Each description listed in column B will be used only once.

Column A

____ (1) Zinc oxide-eugenol cements.
____ (2) EBA cements.
____ (3) Zinc silicophosphate cements.
____ (4) Resin cements.
____ (5) Polycarboxylate cements.
____ (6) Gutta-percha. A.

Column B

a. A thermoplastic natural gum used primarily to fill the root canals of teeth during endodontic procedures.
b. Used both as a cementing medium and for temporary restoration of posterior teeth. A combination of silicate cement powder and a powder of zinc oxide and magnesium oxide.
c. Probably the most effective materials known for temporarily filling teeth before a permanent restoration is placed in the mouth. Used as temporary fillings, as thermal insulating bases, and as root canal fillings.
d. Based primarily on poly (methyl metacrylate) with mineral fillers. Their principal advantage is that they are virtually insoluble in water.
e. Improved or reinforced zinc oxide-eugenol cements as a result of the addition of ortho-ethoxybenzoic acid to the eugenol and quartz or alumina as a filler to the powder.
f. Only cement for which there is evidence of adhesion to the tooth structure. A powder-liquid system in which the liquid is a viscous aqueous solution of polyacrylic acid and water.

4-5. Insulating Materials

Even though the dental profession has developed many dental materials that have proven to be highly desirable, it has not yet developed the perfect restorative (filling) material. Such a material would provide all the qualities of natural tooth structures. To date, one of the problems with these dental materials has been that many possess very poor insulating qualities.

Those that insulate against some and possibly all irritants are usually deficient in other restorative properties. The result has been the requirement for separate insulating materials.

287. State the purpose of insulating materials, and describe their uses and mixing procedures.

Insulating Materials. Insulating materials are used to protect the vital dental pulp from thermal, chemical, electrical, and other possible sources of irritation. Though researchers have been unable to find the perfect insulating material for the dental pulp, several products are considered valuable. While some of them provide adequate strength, they are inadequate as thermal insulators. Others may be adequate as thermal, electrical, and chemical insulators but inadequate in crushing strength. As a result, the dental officer has a variety of insulating materials to choose from and selects the insulator best suited for the particular treatment rendered. The most common insulators, in addition to zinc phosphate cement, are variations of calcium hydroxide and zinc oxide mixed with eugenol (oil of cloves).

Calcium hydroxide. Pure calcium hydroxide is a fine white powder. It is relatively nontoxic and is used by both the medical and dental professions as a protective material. It is widely used in dentistry as a pulp-capping material because it seems to stimulate the production of secondary dentin. It is also used as a base to support to support permanent restorations. This insulating material is available in powder and paste forms. The powder is sometimes mixed with either sterile water or a local anesthetic to form a paste. The *Federal Supply Catalog* lists calcium hydroxide in two different paste types.

Hard-setting type. This type arrives in two tubes—one tube of base paste, one tube of catalyst (to accelerate chemical setting action)—and a mixing pad. To mix them, place small, equal portions of base and catalyst on the pad and mix them. When mixed, the hard-setting type is used as a rigid base to buttress restorations. Dycal is brand most often supplied to Air Force dental clinics. *Soft-setting type*. The soft-setting type arrives in a paste form and is used for pulp capping in pulpotomy procedures and as a cavity liner under cement bases. This material comes in a single tube, so no mixing is necessary. Pulpdent is the soft-setting material most often supplied to Air Force dental clinics.

Zinc oxide and eugenol. A combination of these two ingredients is used in surgical dressings, in impression materials, in root canal sealing materials, in base material under restorations, in cementing agents, and in temporary or sedative-filling materials. It also is used in surgical dressings because of its soothing effect on tissues and because it possesses mild antiseptic qualities. The major disadvantages of this combination are its low-crushing strength and its solubility in oral fluids.

Zinc oxide and eugenol are frequently classified as dental cements and are also very good insulating materials.

Zinc oxide and eugenol paste. The 6520 *Federal Supply Catalog* lists zinc oxide and eugenol in paste form for use as pulp protectors or as insulating materials. Cavitic is the brand most commonly supplied. Like the hard-setting type of calcium hydroxide, zinc oxide and eugenol pulp protective paste arrives in two tubes: one tube of base material and one tube of catalyst. To prepare a zinc oxide and eugenol paste mix, use equal lengths of material from both tubes. You may mix the two on the small parchment pad supplied. This cement will set to a very hard consistency in 3 to 4 minutes, making it usable as a base material under restorations.

Cavity Liners and Varnishes. Cavity liners and varnishes are the least effective of the dental insulating materials. In fact, they are usually not classified as insulators at all. In spite of their inefficiency as thermal insulators, cavity liners and varnishes do serve to partially insulate tooth structures from certain materials. For example, they are used to support zinc phosphate cement bases and silicate cements. For this reason, cavity liners and varnishes are better known as sealers than as insulators. They seal dentinal tubules exposed during tooth preparation.

Cavity liners are primarily resins in solution in a solvent, whereas cavity varnishes are actually varnishes in solution in a solvent. The solvents used in these solutions are volatile and evaporate readily. Because of this property, the solutions become thick after prolonged use and you must add a thinner to return them to a usable consistency. The manufacturer supplies the liners and varnishes in sets, each containing a bottle of the sealer and a bottle of thinner. No mixing is required with this material. The dentist simply moistens a cotton pledget in cavity varnish and applies it to the cavity preparation.

Exercises (287):

1. What is the purpose of insulating materials?
2. Why is calcium hydroxide widely used as a pulp-capping material?
3. Describe the mixing procedures involved with the hard-setting type of calcium hydroxide paste.
4. With what do you mix calcium hydroxide powder to form a paste?
5. How do you mix the paste forms of zinc oxide and eugenol?
6. What is frequently used as a catalyst for zinc oxide and eugenol cement?
7. How much powder should you incorporate into the liquid when you mix zinc oxide and eugenol sealant?

8. Can you add liquid to a mixture of zinc oxide and eugenol without adversely affecting the mixture?

9. State the uses of cavity liners and varnishes.

10. What action should you take if the cavity line or varnish solution gets too thick to use?

4-6. Dental Prosthodontic Materials

Materials used in the prosthodonic section are instrumental in making artificial dental appliances, crowns, inlays, and other dental prostheses. We have already discussed some of the resins used in prosthodontics and will not include all of them under this heading. We will cover impression materials in a separate section because they are so numerous. In this section we will consider acrylic resins, gypsum products, and dental waxes.

288. State the uses of the dental resins.

Dental Resins. The use of dental resins or plastics has been steadily increasing since the late 1930s. A considerable amount of refinement and improvement have been made in both the handling and processing of dental resins. True resins are derived from plant secretions, but those used in dentistry are synthetic resins. The synthetic resin, methyl methacrylate, is the most widely used type. It is also referred to as acrylic resin and is available in two different forms: heat-curing and self-curing. Heat must be applied to the heat-curing form before it will harden. The self-curing form hardens at room temperature.

Denture base material. Denture base materials are available in gel form of in a set containing a powder (polymer) and a liquid (monomer). The powder and liquid set is the most widely used in Air Force dental clinics. The heat-cure resins are used to construct the bases of full and partial dentures. The Federal Supply Catalog lists the heat-cure denture base materials as clear; pink; and fibered, light pink.

The self-cured denture base materials used for making denture repairs are pink repair; and fibered, light-pink repair. ***Resin crown material.*** Although most anterior crowns fabricated in the dental laboratory are constructed of porcelain, occasionally the acrylic crown is desired. Acrylic resin crowns are fabricated in the dental laboratory using a heat-curing process. These crowns are made from resins that are shaded to match closely the color of the patient's natural teeth. Resin crowns are usually made for anterior teeth. Acrylic resin material can also be used for acrylic veneer crowns. The resins used as the veneer (outward layer visible in the patient's mouth) on acrylic veneer crowns are also shaded to match natural tooth shades. These resins are applied to a metal crown (usually a gold-alloy crown) to give the crown a natural appearance. The resins used on these crowns are usually the heat-cure type, but sometimes minor repairs are made with shaded, self-curing resins.

Impression tray resins. During the fabrication of full dentures, partial dentures, and crowns, the prosthodontist may want to make a final, detailed impression by using a customized impression tray. Such customized trays are made with a special self-curing acrylic resin. This tray resin material is usually light blue or white in color.

Exercises (288):

1. Which form of acrylic resin is most often used for making denture repairs?

2. What terms apply to the powder and the liquid used to make denture base material?

3. How are resin crown materials used in dentistry?

4. How are impression tray resins used in dentistry?

289. State characteristics of the gypsum products and specify their uses.

Gypsum Products. Gypsum products are supplied as a powder. When it is mixed with water in the right proportions, the powder forms a paste that gradually solidifies. This setting, or hardening process takes place over a period of several minutes, during which time the mixture is soft and pliable and can be formed into the desired shape. The setting process accelerates as it progresses. As it finally solidifies, the material gives off an appreciable amount of heat, which is characteristic of all gypsum products. Each of the materials in the gypsum group is carefully compounded to give it the particular combination of physical properties needed for a particular job. Plaster of Paris and artificial dental stoe are the most frequently used gypsum products.

Plaster of Paris. Under a microscope, gypsum appears to be composed of tiny crystals; and each crystal contains a definite amount of water. You can convert the gypsum into plaster by grinding it into small particles and heating it slowly to remove the water. The amount of water that is removed by heating determines the behavior of the plaster when you again mix it with water. Plasters made for dental use are specially processed to provide high purity and suitable working properties. These properties must be uniform within each batch and from one batch to another. One of the most important requirements is that the plaster must be set within a definite time limit. The amount of its setting expansion must also be within reasonable limits.

Plaster has many uses. You can use it to form casts, to construct matrices, to attach casts to the articulator, to combine as an ingredient in certain high-heat investments, and to make certain impressions. The initial setting time for most dental plaster ranges 5 to 12 minutes. The final setting is complete within approximately 45 minutes.

Dental stone. Chemically, dental stone hydrocal is very similar to plaster of Paris, but since the method of manufacturering somewhat differs, the two differ in their physical properties. If you compare stone and plaster particles under a microscope, you will see that the plaster particle is long, needlelike, and quite porous. Onm the other hand, the dental stone particle is smaller, much more dense, and relatively nonporous. For this reason, dental stone requires less water in mixing and sets more slowly. When it is set, it is harder, denser, and has a higher crushing strength. These properties make stone preferable to plaster as a master cast in complete and partial denture construction. It can withstand more pressure in flasking and packing and you are less apt to scratch it or damage it in the laboratory. Stone has many dental uses, including pouring casts and dies and flasking dentures for processing. Dental stone is colored by the manufacturer to make it easily distinguishable from plaster. Common colors used include yellow, pink, and green. The initial set of a typical stone mix varies from 7 to 15 minutes. You can complete the final set within approximately 45 minutes.

Exercises (289):

1. What is "given off" by all gypsum products as final solidification takes place?

2. List four dental uses of plaster of Paris.

3. What are the initial and final setting times for plaster of Paris?

4. Which process requires more water: mixing hydrocal or mixing plaster of Paris?

5. What are the most frequent uses of dental stone?

6. Give the initial and final setting times for dental stone.

290. Given a list of dental waxes, identify their uses and characteristics.

Dental Waxes. Dental waxes are used at some stage in the construction of all dentures, inlays, crowns, and in many other maxillofacial appliances. The waxes are supplied in many different forms, each with specific properties designed for an intended purpose. It is important to use the proper wax for a required task.

Baseplate wax. Baseplate wax is supplied in two types: hard (Type I) and medium (Type II). The hard Type is better for warm temperatures because it resists flow at higher temperatures, but it may be too brittle and have a tendency to crack at lower temperatures. The medium type is satisfactory for colder temperatures, but it may exhibit too much flow in a warmer environment. Baseplate wax is used for occlusal rims, as a boxing matrix, and for many miscellaneous purposes. This wax is pink and is available in both sheet form and in the 1½ inch-wide ribbon form, which is rolled in a dispenser carton.

Bite wax. Bite wax is a metal-impregnated wax used by the dentist to transfer the occlusal relationship of teeth from the patient to the casts. This permits the dental laboratory specialist or technician to set the teeth in the proper position.

Boxing wax. Boxing wax is a red, specially prepared wax, which is supplied in strips about 1 ½ inches wide and 12 inches long. Use it to box impressions. (Boxing is the act of inclosing the impression with a matrix when pouring a cast with stone or plaster.) Use it also to make a plaster matrix when a complete denture is duplicated.

Indicator wax. Indicator wax is coated with a water soluble adhesive on one side. It is usually green and is used for registering occlusal contact on natural teeth, individual restorations, fixed partial dentures, removable partial dentures, and complete dentures. It is sometimes used by the dentist to determine premature contact (high spots) on restorations.

Inlay wax. Inlay wax is one of the most carefully compounded of all the dental waxes and is used to make wax patterns for crowns, inlays, and pontics. Inlay wax is supplied in sticks, in both hard (dark blue) and medium (blue) grades, and also in ivory or white with no color pigment. This last type is used for waxing the pattern for acrylic jackets because it does not leave a colored residue in the plaster mold. A colored residue would discolor the resin of the jacket crown.

Sticky wax. Sticky wax is made of beeswax, paraffin and resin. It is dark blue, dark red, dark violet, or orange. The resin gives the wax its adhesiveness and hardness. An important requirement of sticky wax is that it must break under pressure rather than bend or distort. This property makes it useful for holding the parts of a broken denture together so that it can be repaired.

Utility wax. Utility wax is a red wax that is supplied in round, rope form. It is extremely pliable and somewhat tacky at room temperature, which makes it usable without heating. The most important use of utility wax is in beading (outer trimming) impressions before boxing and pouring the model. It has various other applications, one of which is its use on impression trays to avoid injury to soft tissue.

Disclosing wax. Disclosing wax is an ivory-colored wax that comes in a paste form. It is extremely low fusing, melting at mouth temperature. Use disclosing wax to determine the fit of full and partial dentures.

Exercises (290):

1. Match the uses and characteristics of the waxes in column A with their correct descriptions in column B.

Column A

____ (1) Boxing wax.
____ (2) Utility wax.
____ (3) Inlay wax.
____ (4) Baseplate wax.
____ (5) Sticky wax.
____ (6) Indicator wax.
____ (7) Disclosing wax.
____ (8) Bite wax.

Column B

a. A metal-impregnated wax used to transfer the occlusal relationsip of the teeth from the patient to the casts.
b. A wax supplied in a strip about 1½ inches wide used to inclose the impression with a matrix when you pour a cast.
c. Composed of beeswax, paraffin, and resin, this wax will break rather than bend under pressure. It is used to hold the parts of a broken denture together so that it can be repaired.
d. The most carefully compounded of all the waxes, it is used to make wax patterns for crowns, inlays, and pontics.
e. Used to bead impressions and protect soft tissue during impressions; this wax is pliable and somewhat tacky at room temperatures.
f. Ivory-colored, low fusing wax that comes in a paste form. It is used to determine the fit of dentures.
g. Available in hard and medium types for use in different climates, this wax is used for occlusal rims.
h. Coated with a water soluble adhesive on one side, this wax is used for registering occlusal contact on teeth, restorations, and dentures.

4-7. Impression Materials

Much of the work done in making dental appliances, including crowns and inlays, is done outside the mouth on stone casts. The use of casts improves access to the work area and prevents injury to oral soft tissues from hot waxes and other harmful material. Such procedures as casting and soldering cannot be done in the patient's mouth.

291. State the use of dental impression materials, and identify their characteristics.

To make a stone cast, there must first be a negative reproduction of a patient's mouth. A negative reproduction is obtained with impression material. It is then poured up with a gypsum product, producing a positive reproduction called a cast. Though there are many types of impression materials used for this purpose, no one material fulfills all the requirements for making a perfect negative reproduction of the oral structures. Because clinical situations and dentists' techniques vary, so will the choice of the material. There are several ways in which the impression material may be classified: according to its rigidity, plasticity, chemical reaction, elasticity, and use.

Plastic Compounds. Plastic impression compounds soften when heated and harden when cooled, with no chemical action taking place. The exact composition of a plastic impression compound varies with the type and the manufacturer. These plastic compounds come in several colors (red, green, black, gray) and in stick or cake (wafer) form. These materials are used to make personalized impression trays and impressions. The plastic compounds must be heated in a water bath before they are placed in impression trays. They are divided into two types. Type I compound is a low-temperature fusing material. It is used with copper bands for inlay and crown impressions and for recording "functional" or "preliminary" impressions. Type I compound softens between 126° F and 144° F and is compatible with the oral tissues. Conversely, type II compound is a high-temperature fusing material, relatively tough, and strong enough to act as a tray to support other types of impression materials. Materials of this type soften at a temperature above 158° F and are not compatible with oral tissue because of this higher temperature. Be careful when you soften this material because overheating makes it so sticky that it is extremely difficult to handle. When it cools, plastic impression compound becomes hard and brittle. Trimming an impression correctly requires a sharp knife to reduce the possibility of breakage.

Wax Compounds. Impression wax is a low-temperature fusing material that can be used as a "wash" to correct defects or deficiencies in other impressions. It is specially compounded so that it flows at mouth temperature. After this wax is melted in a water bath, it is painted in the individual impression tray to serve as a corrective liner for final impressions. If you rinse the impression, do so very carefully with cool water. Also avoid touching the wax areas with your fingers because they may cause the wax to flow and distort the impression surface.

Impression Paste Compounds. Impression paste is also used as a corrective "wash." This paste contains zinc oxide and eugenol and is supplied in two tubes. One tube contains the base material, the other the hardener. Equal lengths of material from each tube are used. Because cleaning up after preparing this material is difficult, you will save time by mixing it on a parchment pad, using a tongue depressor for a spatula. You can discard both the parchment sheet and the tongue depressor when you have finished. If you want to increase the setting time of this material, decrease the amount of hardener. To decrease the setting time, increase the amount of hardener. As with all the materials we have discussed previously, you should read and follow the manufacturer's instructions.

Rubber-Base Compounds. The rubber-base compounds are soft, synthetic, rubberlike materials, supplied in two collapsible tubes. One tube contains a base and the other a hardener. When the two are mixed in the proper proportions, the resulting mixture sets in a semihard, rubbery state. These materials have a short shelf life because of their unstable polysulfide base.

Rubber-base impression materials can be used for almost any type of impression. They come in three consistencies:

a. Light bodied, to be injected with a syringe onto preparations for inlays, crowns, and fixed partial dentures.

b. Regular bodied, to be used in a impression tray for inlays, crowns, and fixed partial dentures and as "wash" impressions for full dentures, relinings, and removable partial dentures. Its high degree of flow registers the fine details.

c. Heavy bodied, to be used in a tray to force light bodied impression material onto the cavity preparation or with a copper band for impressions of single teeth.

Rubber-base impression materials should be mixed with 45 to 60 seconds. Using a stirring motion, mix the base and hardener until the mix is free of color streaks and is uniform in shade. After the mix is prepared, load the syringe on the impression tray.

Hydrocolloid Compounds. Colloids are suspensions of particles, or small groups of molecules, in some type of dispersing medium. In this solution the very fine particles are not visible under an ordinary microscope and will not settle out upon standing. As indicated by the prefix *hydro-*, which means water, a *hydrocolloid* is a colloid in which the dispersing medium is water.

A colloid has two phases: one phase, in which it is in liquid *sol*ution, is known as a sol (remember sol, as in solution); the other, which is a semisolid form similar to jelly, is known as a *gel* (remember gel as in jelly, but be careful of the spelling).

The change from the sol (liquid) to the gel (solid) can be caused by thermal or chemical changes. Hydrocolloids that change state because of thermal changes are knowns as *reversible hydrocolloids* because the process can be changed back and forth by altering the temperature. Those that are altered through a chemical change are known as *irreversible hydrocolloids*, because once the chemical change has taken place, it cannot be reversed, or turned back, to the previous state.

Reversible hydrocolloids. Jello is an excellent example of a reversible hydrocolloid. The powder is mixed with water to form a liquid solution, the sol phase. It is chilled and becomes a semisolid gel. The temperature at which this change from the sol state to a semisolid gel state takes place is known as the *gelatin temperature*. If the jello is brought again to room temperature, it will "melt" and return to the liquid, sol state. However, if again refrigerated, it will return to the gel phase. Thus, this material is a reversible hydrocolloid because it can be made to change state through temperature changes. Although jello is not suitable as a dental impression material, other reversible hydrocolloids with similar characteristics are used. *Agar impression materials* are the reversible hydrocolloids used in dentistry, and they are commonly referred to as "hydrocolloids."

Irreversible hydrocolloids. Those hydrocolloids in which change is brought about by chemical reactions are known as irreversible hydrocolloids. Instant pudding is an example of an irreversible hydrocolloid. When the powder is actively mixed with the milk, the liquid solution quickly changes into a semisolid gel (milk, which has a large water content, serves as the dispersing agent and also takes part in the chemical reaction). This change occurs without refrigeration and is caused by chemical reactions within the solution. However, this material cannot be returned to the liquid state, hence it is known as an irreversible hydrocolloid. Instant pudding is not suitable as a dental impression material; however, *alginates*, which are irreversible hydrocolloids with similar characteristics, are widely used.

Agar Impression Materials. Reversible hydrocolloids based on the polysaccharide agar-agar were the first impression materials that could make accurate one-piece impressions of undercut surfaces. Their development by Alphons Poller of Vienna in about 1925 was a significant advance in prosthetic dentistry.

Alginate impression material has largely displaced the agar type for impressions of partially edentulous mouths. The agar material is still used for making impressions of crown and bridge preparations, especially when large sections of the dental arches are included.

The exact compositions of the commerical agar-type hydrocolloid impression materials have not been published. The main ingredient, by bulk, is water (sometimes as much as 85 percent); however, the principal effective ingredient is agar-agar (about 12 to 15 percent). Other ingredients are added in small amounts to serve color, flavor, or preservative functions; to obtain the desired consistency or strength properties; or to make the materials more compatible with gypsum products.

Dental agar impression material is covered by ADA specifications which includes the following requirements: the odor and flavor must be pleasant, the material must not irritate oral tissues, and the temperature of the gel formation must range from 98.6° to 113° F. To ensure a minimum of reaction between the impression materials and gypsum, the specification requires that the impression materials do not cause surface deterioration of the gypsum cast.

Preparation and use of reversible hydrocolloid impression materials. Hydrocolloid impression material exists in both tray and syringe forms. Both of these forms must be conditioned prior to use. To prepare the hydrocolloid, the material must first be boiled for at least 10 minutes in a *liquifying* bath (water bath with a heater). This step brings the material to the liquid sol state. It may then be stored for later use (up to 5 days) by placing it in a *storage bath* at approximately 150° F. Prior to taking the impression, the tray material is loaded into a special "water-cooled" tray and immersed in a temporary bath between 110° and 120e F.for 5 to 10 minutes.

Alginate Impression Materials. Irreversible hydrocolloids, more commonly known as alginates, were developed from seaweed during World War II when agar became scarce. Now their use far exceeds that of the reversible hydrocolloid agar material.

The primary advantages of alginate impression material are that it is easy to prepare and handle, it does not require extensive equipment and advance preparation, it is comfortable for the patient, and it is relatively inexpensive. However, alginate does not produce accurate or sharp enough details to be used for final impressions; and its use is limited primarily to study casts, preliminary impression, and orthodontic casts.

Under ADA specifications, alginate materials are divided into two types, based on gelling time. Type I, a fast-setting type, must gel in 60 to 120 seconds. Type II, a normal-setting type, must gel in 120 seconds to 4 minutes and 30 seconds after the beginning of the mix. Also under ADA specifications, the manufacturer is required to include detailed instructions for use. The assistant should read and follow these instructions carefully.

Composition and chemistry. The exact formula for an *Alginate* impression material varies with the manufacturer; however, the chief ingredient necessary for chemical reaction is soluble potassium alginate. When activited by a *reactor*, such as calcium sulfate, the potassium alginate readily dissolves in water to form a viscous sol. This action must be delayed long enough to allow time for mixing the materials and loading the tray and positioning it in the patient's mouth. Add a *retarder*, such as trisodium phosphate, to the formula to make this possible.

Unused alginate impression materials deteriorate rapidly at elevated temperatures or in the presence of moisture or under both conditions. They may change by failing to set at all or by setting too rapidly. Alginate materials should be stored in cool, dry locations. Premeasured foil packages assure an accurate measure and protection from moisture contamination and atmospheric conditions. If the material is used from cans, the cans should be stored in a cool dry place with the lid tightly replaced immediately after use.

Preparation and use of alginate impression materials. Maximum gel strength is required to prevent tearing (fracture) and to assure elastic recovery of the alginate impression upon its removal from the mouth. All the manipulative factors affect the gel strength, and each should be carefully controlled to assure best results.

Gelation time—the time required for the gel to form—is commonly referred to as *setting time*. This time factor is *important* because too rapid gelation does not permit adequate working time. Too long a setting time is tedious for both the operator and the patient. Once the gelatin starts, it must not be disturbed, since any distortion of the material will be permanent.

Temperature is important for high temperature can speed the setting time, whereas cold can retard it. The temperature that varies most commonly is that of the water used in mixing the alginate. Water at 122° F can cause a setting time of only 1.8 minutes, whereas water at 43° F increases setting time to 7.8 minutes. The manufacturer's directions list the recommended water temperature. For best results, follow the directions and routinely use a thermometer to check the water temperature.

Exact proportions of water and powder are essential to achieve a good mix of alginate. Along within instructions, the manufacturers usually supply volume measures for both water and powders. Manufacturers' instructions should be followed exactly in using these, and the assistant should accurately measure all materials.

A mixing time of 1 minute is usually recommended, and the mixing period should be carefully timed, for this is an important factor. Insufficient spatulation causes failure of the ingredients to dissolve sufficiently so that the chemical reactions can proceed uniformly throughout the mass. The strength of the gel can be reduced as much as 50 percent if the mixture is incomplete. Conversely, if the mixing time is unduly prolonged, the gel will be broken up as it is forming, and the strength will be decreased.

The strength of the alginate gel increases for several minutes after initial gelation. For this reason, the operator does not remove the alginate impression from the mouth for at least 2 to 3 minutes after gelation has occurred. This is approximately the time at which the material loses its tackiness.

Care of the impression. An alginate impression should be poured immediately. If it is left out in the air, *syneresis* (the loss of water) will cause the impression to shrink and become distorted. If it is soaked in water, inbibition (the intake of water) will cause the impression to swell.

Exercises (291):

1. What purposes are type I plastic compounds used?

2. What precautions must be observed when handling Type II plastic compounds?

3. Describe the use of wax compounds.

4. How do you increase the setting time of impression paste compounds?

5. Why do rubber-base compounds have a short shelf life?

6. Briefly explain the use of each type of rubber-base impression material.

7. What is a hydrocolloid?

8. Describe the two phases of a colloid.

9. What are the two types of hydrocolloids?

10. What specifications do dental agar impression materials possess?

11. Describe the two types of alginate.

12. What causes the deterioration of alginate impression materials?

13. How does temperature affect alginate setting times?

14. What care should be used when handling an alginate impression?

4-8. Endodontic Materials

The main materials used in root canal therapy are various liquid antiseptics, paper points, gutta-percha points, and silver points and sealers. The dental officer uses these to treat and fill a properly prepared root canal from which the pulp has been removed.

292. Characterize the use and properties of endodontic materials.

Paper Points. Paper points are primarily used during the treatment phase of endodontics to dry out canals. They are usually saturated with an antispetic (ethyl alcohol, camphorated parachlorophenal, and sometimes creosote) and inserted into the prepared canal to act as antiseptics (bacterial growth inhibitors) and bactericidals (bacterial destruction agents). Paper points are never used as permanent root canal filling materials.

Root Canal Restorative Materials. Root canal restorative materials are used to fill the previously prepared root canals, and complete the root canal or endodontic therapy. Root canal restorative materials consist of tapered gutta-percha or silver points, in a variety of standard sizes, and root canal sealers or cements. A good root canal restorative material should be insoluble in tissue fluids, opague to the passage of X-rays, reasonably easy to remove, nonirritating to periapical tissues, nonabsorbent, and dimensionally stable after its insertion into a root canal.

Gutta-percha. Gutta-percha is used as a temporary restoration and as a root canal restorative material. Gutta-percha is the refined, coagulated, milky exudate of certain trees in the Malay Peninsula of Southeast Asia. It is pink or gray in color, softens when heated, and is easily molded. When it is cool, it maintains its shape faily well. Gutta-percha points have been a choice for root canal restorative materials for many years. The material has many advantages as follows: it has a high thermal expansion, does not shrink unless used with a solvent, is radiopaque, can be kept sterile in an antispetic solution, is resistant to moisture, is bacteriostatic, and is a poor conductor of heat. On the other hand, gutta-percha shrinks when it is used with a solvent and is not always easily inserted into the root canal. Gutta-percha points are prepared for insertion by disinfecting them in tincture of metaphen or by washing them in alcohol. They are then air-dried and cemented into the root canal with root canal cement or sealer.

Silver points. The dental officer may also use silver points to fill the root canal. They share many of the advantages mentioned for gutta-percha. Silver points, however, are easier to insert in small canals and come in the same sizes and tapers as standard root canal files and reamers. The main disadvantage in the use of silver points is that they are hard to remove from the root canal, difficult to seal properly, and by themselves do not conform completely to the shape of the canal. The dental officer first selects the silver point, fits it to the canal, and prepares it for insertion by passing it through a thin mix of root canal sealer or cement. It is then inserted into the root canal, which has been previously coated with the cementing medium.

Root Canal Sealers. The root canal sealers most commonly used in American dentistry are packaged in cement and paste forms. The zinc oxide and eugenol type is the one most often used. The liquid is eugenol, and a typical zinc oxide powder formula may contain several ingredients as follows:

a. Zinc oxide—main ingredient.
b. Resins—vegetable or mineral oil types.
c. Thymol iodide—a bactericide.
d. d. Bismuth subcarbonate—an antacid.

In addition to the above ingredients, some formulas contain silver particles or barium sulfate, which add radiopaque (ability to stop radiant energy, such as X-rays) qualities. These ingredients are mixed in much the same way as in zinc phosphate cement. Using a glass slab and a noncorroding spatula, incorporate the powder into the liquid until a thick, creamy consistency is reached. The pastes sometimes used as sealers are chloropercha and eucapercha. They are made by dissolving gutta-percha in either chloroform or eucalyptol. The cements are used to cement both silver and gutta-percha points in place, but the pastes are usually used with gutta-percha points only.

Exercises (292):

1. How are paper points used during endodontic treatment?

2. What characteristics should a good root canal filling material possess?

3. How is gutta-percha used as an endodontic material?

4. What are the disadvantages when gutta-percha is used as an endodontic material?

5. List the main disadvantage of using silver points as a root canal restorative material.

6. Name the type of root canal cement most often used.

7. How are the root canal pastes that are used as sealers manufactured?

4-9. Surgical Dressings

During the course of oral and periodontal surgery, the dental officer exposes oral soft tissues and sometimes bone, leaving raw wounds. Surgical dressing materials are usually applied to the wounds as a protective barrier. They are sometimes referred to as "surgical packs."

293. Cite the uses of surgical packs, and identify the purpose of each of their ingredients.

Surgical Packs. Surgical packs are placed on soft tissue or bony wounds to act as both a protective barrier and a soothing and healing agent. They are primarily used as a gingival bandage after periodontal surgery. These packs not only protect the area by preventing food from touching the excised margins but also soothe and aid in healing the tissues. Your main duty will be to mix the ingredients and form the packs that the dental officer places in the patient's mouth.

Types. There are two types of surgical dressings: those that contain eugenol and those that do not. The dressings containing eugenol are more widely used. Any of five commerical brands of surgical dressings may be used in your dental clinic. Dressings with eugenol are made by Kirkland, Ward, Schlein, and Professional Products companies. A noneugenol type is Col-Pack. This type is usually used on patients whose surgery left some exposed bone or who are allergic to eugenol.

Local formulation. Many dental officers prefer to obtain the hospital pharmacy a powdered mixture with which to mix the desired liquid. One such dressing is Glickman's formula. The formula for this powder mixture, blended at the pharmacy, contains the following ingredients in the amounts shown:

Zinc oxide	63 grams
Resin	30 grams
Asbestos fibers	5 grams
Zinc acetate	2 grams

To this powdered mixture, the liquids necessary for the proper consistency are:

Eugenol	80 cc
Olive oil	20 cc

Eugenol and zinc oxide are both agents that soothe pain. Powdered resin and asbestos fibers give strength to the dressing so that it can remain in the mouth for the required time—usually 5 to 7 days. The dental officer may vary the above formula. The dental officer may want to add thymol or other aromatic oils to give a more desirable flavor to the dressing and coloring agents to make the dressing less noticeable in the patient's mouth. Tannic acid can be added to check bleeding. The dental officer may use foil between the tissues and the dressings so that no sutures become embedded in the periodontal dressing as it hardens.

Exercises (293):

1. Why are surgical packs used?

2. On which patients would a noneugenol type of surgical pack be used?

3. Match the purpose of each ingredient in the surgical pack in column B with the ingredient in column A. Column B items may be used more than once.

Column A	*Column B*
____ (1) Tannic acid.	a. Strength.
____ (2) Thymol.	b. Flavor.
____ (3) Resin and asbestos fibers.	c. Checks bleeding.
____ (4) Zinc oxide and eugenol.	d. Soothing effect.

4-10. Miscellaneous Dental Materials

In addition to the materials we have already covered, there are other materials that have an important place in dentistry. For lack of a better classification, we call these miscellaneous dental materials.

294. Given a list of miscellaneous dental materials, select the correct use of each.

Temporary Stopping. Temporary stopping is a temporary restorative material. It is usually composed of gutta-percha, waxes, zinc oxide, and, possibly, powdered feldspar or silex. This material dissolves in the mouth fluids to some extent. It is easier to hand tole and manufacture than gutta-percha but does not wear as well. It can be made plastic by heating or can be dissolved in chloroform or eucalyptol.

Dental Porcelain. Dental porcelain is manufactured in the form of a powder. When it is heated to a very high temperature in a special oven (called baking), it fuses into a homogeneous mass. When it cools, the mass is hard and dense. Dental porcelain is manufactured in a variety of shades to match most tooth colors. The translucency of baked porcelain is like that of dental enamel. This allows porcelain crowns, facings, pontics, and inlays of a highly pleasing appearance to be made.

Baseplate Materials. Baseplate materials are used in constructing full and partial dentures, bite-rim foundations, and impression trays. Baseplates are usually softened over an open flame, molded over a cast, and then trimmed. Most baseplates are composed of resins and shellac, with various powders used as fillers.

Impression Adhesive. Impression adhesive is a special gluing agent for bonding rubber-base impression materials (polysulfide) to impression trays. It can bond the polysulfide to metal, acrylic, or compound impression trays. Impression trays are coated with this adhesive before they are filled with rubber-base impressive material. This insures that the impression material stays in the tray when it is removed from the mouth.

Dental Abrasives. Unless the surfaces of the restorations and appliances are smooth and highly polished, they cannot be kept clean. Food, debris, and salivary deposits collect on a rough surface, producing calculus. If all the surfaces of the restorative materials and the natural teeth are smooth and polished, the cleansing action of the tongue, assisted by proper toothbrushing or denture cleansing, should prevent the formation of any permanent deposits. In dentistry, materials called dental abrasives are used for smoothing and polishing the restorations and appliances that are placed in the mouth.

Pumice. The first of these materials is pumice, a finely ground, sandlike material used as an abrasive and polishing agent for acrylic resins, amalgams, and gold. It is mainly composed of complex silicates of aluminum, potassium, and sodium. The *Federal Supply Catalog* lists two grades: flour of pumice and coarse pumice. Flour of pumice is used for putting the final shine on appliances and for polishing restorations. Coarse pumice is primarily used in the dental laboratory as an initial rough polish for dentures. Coarse pumice should never be used in the patient's mouth.

Zirconium silicate. A material that has largely replaced pumice for polishing teeth is zirconium silicate. Zirconium silicate is mixed with water or a stannous fluoride solution to prevent caries.

Tin oxide. This is another material used to polish teeth and restorations. It is a fine, white powder that is made into a paste form by mixing it with water or glycerin.

Chalk. Chalk (whiting) is used as a polishing agent for both acrylic resins and metals. Its main component is calcium carbonate.

Rouge. This is a polishing agent, not used in the mouth, that imparts a high luster to gold. It is composed of iron oxide and is usually supplied in cake or stick form.

Tripoli. This polishing agent is used in the dental laboratory for gold and other metals. It is made of certain porous rocks found near Tripoli in North Africa and is supplied in cake form. Tripoli is slightly more abrasive than rouge and is usually used just before the rouge is used.

Abrasive paste. The final material in this group is dental abrasive paste. This is made from very finely ground silicone carbide particles incorporated in a greaseless base. Its primary use is to "mill-in" complete dentures, but it can also be used to increase the abrasive action of the carborundum stones used in tooth preparation.

Exercises (294):

1. Match the use of each of the miscellaneous dental materials in column B with the material in column A.

Column A

____ (1) Baseplate materials.
____ (2) Coarse pumice.
____ (3) Rouge.
____ (4) Temporary stopping.
____ (5) Impression adhesive.
____ (6) Tripoli.
____ (7) Zirconium silicate.
____ (8) Abrasive paste.
____ (9) Porcelain.

Column B

a. To impart a high luster to gold.
b. For polishing teeth.
c. As a temporary restorative material.
d. For making bite-rim foundations.
e. A polishing agent usually used just prior to rouge.
f. To "mill-in" complete dentures.
g. As an initial rough polish for dentures.
h. To hold rubber-base impression material in the tray.
i. To produce crowns, pontics, and inlays of a highly pleasing appearing.

Dental Therapeutics

IN THE FIELD of dentistry, several drugs may be used to treat a dental patient. While you do not prescribe drugs, you may be asked to prepare medications and to aid the dental officer to administer them. In either instance, a knowledge of drugs enables you to perform your duties with expertise and confidence, enables you to aid during emergency situations, and helps to lessen drug abuse. Properly used drugs can aid in rendering a diagnosis, in treating or preventing a disease or other abnormal condition, in relieving pain or suffering, and in controlling or improving any physiological or pathological condition. Improper use of drugs can cause physical and mental impairment and even death. In the interest of human life, experimenting with drugs should be left to the scientist in drug research laboratories where experiments are carried out under highly controlled conditions. In this chapter we will cover the methods of drug administration, the actions of drugs, and the specific categories of therapeutic agents.

5-1. Drug Administration

As a dental assistant, you assist the dental officer in all phases of patient treatment procedures. One phase of patient treatment involves the administration of drugs. The dentist prescribes the specific drug and the dosage. In some cases you may be asked to prepare the drug for administration by the dentist.

295. Specify facts about the common methods of drug administration, and given definitions of oral dosage forms, associate each with the form to which it relates.

Common Methods of Drug Administration. There are several common methods of administering drugs. Those commonly encountered in the dental clinic are:

- Topical.
- Oral.
- Inhalation.
- Injection.
- Rectal.

Topical. The topical method refers to applying the drug to the surface of the skin or mucous membrane to produce a local effect. Such drugs come in the form of ointment, lotion, or cream. A good example is the topical anesthetic ointment.

Oral. Oral administration of a drug is probably the simplest and easiest method. It is painless, requires no special apparatus, and produces a systemic effect in a short period of time. Drugs for oral administration are in either solid or liquid form. The solid forms are pills, tablets, troches, lozenges, and capsules. Although these terms are sometimes used interchangeably, there are differences in their meanings.

a. A tablet is a compressed or molded solid dosage, which may be coated or uncoated.

b. Troches and lozenges are molded, uncoated tablets that are usually mixed with flavoring agents. They are dissolved in the mouth for their emollient (soothing) effect. They come in various sizes and shapes.

c. Capsules are solid dosage forms, enclosed in either a hard or soft soluble container of a suitable form of gelatin.

The liquid forms used for oral drug administration are solutions, elixirs, and syrups. A solution uses water as a vehicle (carrying agent) for a drug. An elixir is a clear, sweetened liquid, usually containing water and alcohol. A syrup is an aqueous solution of sugar that is used as a vehicle for a drug.

Inhalation. Drugs administered by inhalation are relatively few in number. The highly volatile (easily vaporized) group include ether, nitrous oxide, and oxygen. An inhalant often used in the dental clinic to revive patients who experience syncope is an aromatic ammonia inhalant. Some inhalants are supplied in cylinders equipped with regulators that adjust the flow of the drug and with a face mask for administration. These inhalants are, of course, in gas form. Other inhalants, such as aromatic ammonia, are supplied in liquid form in a cloth-covered vial that can easily be crushed to release the vapors.

Injection. Drugs to be injected are usually prepared with normal saline as the vehicle. However, some drugs that are rapidly absorbed and excreted by the body, such as penicillin, may be suspended in medicinal oils. There are many methods of injecting drugs. Injection methods used in the dental clinic are intramuscular, intravenous, and subcutaneous methods. To inject a drug intramuscularly means to inject into a muscle; to inject intravenously means to inject into a vein; and to inject subcutaneously means beneath the skin.

When you use the intramuscular injection method, you will notice that the onset of the drug's action is slow and that the duration of the action is prolonged. This longer activity occurs because a pool of the medicament is deposited in the muscle, and the medicament is slowly absorbed into the blood stream. The use of oils as a vehicle or the addition of a vasoconstrictor may delay absorption and further prolong the drug's action. Although as a dental assistant you will probably never give an injection, you should be aware of the correct procedures in the event of an emergency. Take care to prevent injection into any of the small blood vessels located in the muscle. After the needle has been inserted into the muscle, aspirate the syringe by pulling its plunger slightly back. If the needle has been inserted into a blood vessel, blood will be pulled into the barrel of the syringe. If this occurs, remove the syringe and its needle and reinsert it another location. Injecting the medicament into the blood vessel results in a more rapid absorption of the drug than is appropriate for intramuscular injections. This could be dangerous to the patient, because the planned dosage was intended for slow absorption. if the absorption occurs too rapidly, it will place too much of the drug into the patient's system at one time.

Subcutaneous injection is similar to intramuscular injection. The onset of the drug's action is slow, and the duration of the action is prolonged. The medicament is deposited under the skin and is slowly absorbed into the blood stream. The same cautions and procedures used for an intramuscular injection apply for subcutaneous injections. The difference between the two methods is the area in which the medicament is deposited.

Intravenous injections produce a very rapid response, since the drug is instantly carried to the tissue upon which it is to act. This injection method is used when a quick response to the drug is desired, as in emergency situations or to monitor a drug's application. Intravenous injections generally should be made slowly. Normally, the dental officer administers any injections (both intramuscular and intravenous) that are given in the dental clinic, and your job is to prepare the drug for administration. This, however, does not rule out emergency situations when you may give the injection while the dentist performs closed-chest cardiac massage or other life-sustaining procedures.

Rectal. Although this method of admisistering medications in not used often in dentistry there may be a time when it is the most appropriate method. An example would be a patient who continues to vomit. You can perform rectal administration of medications with a suppository. Suppositories are a medicated solid body intended for introduction into different orifices of the body. Suppositories usually melt or are softened at body temperature.

Choice of the Administration Method. The dentist chooses the method of administration. The method he or she selects for the administration of a drug depends on several factors.

a. The effect desired.
b. The rapidity of action needed.
c. The nature and amount of the drug to be given.
d. The physical condition of the patient.

Exercises (295):

1. Name the five methods of administering drugs that are commonly used by the dental service.

2. Define the topical method.

3. Why is oral administration of a drug the simplest and easiest method?

4. Match the descriptive statement in column B with the appropriate oral dosage in column A.

Column A	*Column B*
_____ (1) Capsule.	a. Liquid dosage that uses water as a vehicle.
_____ (2) Elixir.	b. Molded, uncoated tablets usually mixed with a flavoring agent. They are dissolved in the mouth for their emollient action.
_____ (3) Solution.	c. A clear, sweetened liquid, usually containing water and alcohol.
_____ (4) Troches and lozenges.	d.
_____ (5) Syrup.	e. An aqueous solution of sugar that is used as a vehicle for a drug.
_____ (6) Tablet.	f. A solid dosage form enclosed in either a hard or soft solution gelatin container.
	g. A compressed or molded solid dosage which may be coated or uncoated.

5. What type of drug administration method is used for highly volatile drugs?

6. What is usually used as the vehicle for drugs that are to be injected?

7. Why is the drug action slow and prolonged when the intramuscular injection method is employed?

8. What is accomplished by the addition of a vasconstrictor or the use of oil as the vehicle in medicaments to be injected intramuscularly?

9. Why is it important not to inject into a blood vessel when giving an intramuscular injection?

10. What injection method is used when a quick response to a drug is desired?

11. What factors does the dentist consider to determine the appropriate method of drug administration?

5-2. Actions of Drugs

To understand how all drugs actually work inside human beings is one of the challenges of modern medicine. It is true that we can easily explain the actions of certain drugs. For example, we know that magnesium sulfate causes water to be retained within the lumen of the bowel and that diarrhea results. But the reason for the actions of many other drugs remains a mystery to us. Nevertheless, we can profit from a look at the actions of drugs that we do understand. This section covers local and systemic drug actions.

296. Define local and systemic drug actions, and specify the criteria to which systemic medications must adhere.

Local Action. A local action is the effect that a drug or medication produces upon tissue at the point or area of application or introduction. Such effects, however, are confined to the site or area of application only if the medication is dispensed in reasonable doses. Included in medications with local action are emollients and demulcents. Emollients, which are fats or oils, protect or soften the skin. Demulcents protect irritated or abraded tissue. Dusting powder, for instance, which is used on the hands before putting on rubber gloves, protects the skin.

Systemic Action. This is the action of a drug on some tissue or organ remote from the site of introduction. Such action occurs only after the drug has been absorbed or after it has entered the vascular system. Before a drug is accepted for use as a systemic medication by the medical profession, it must first meet the following criteria:

a. Be administered so that it is introduced advantageously into the body.

b. Be absorbed. (This presupposes its solubility in one or more of the body fluids and its ability to permeate cell membranes.)

c. Reach specific cells of the body to increase or decrease an already existing function.

d. Be excreted by the body or destroyed within the body. It may be eliminated unchanged or in combination with other waste products of the body, chiefly through the intestines, kidneys, lungs, or skin.

Exercises (296):

1. What is local drug action?

2. What is systemic drug action?

Complete items 3 through 6 by indicating whether the descriptive statements concerning the desired capability for a systemic medication are true (T) or false (F). Explain any false answers.

____ 3. Systemic medications should produce an equal local and systemic effect.
____ 4. System medications should be nonabsorbable in muscle tissues.
____ 5. Systemic medications should reach specific cells of the body to modify an already existing function.
____ 6. Systemic medications should be excreted or destroyed by the body.

297. Match each of the four types of systemic drug actions with the statement which correctly identifies it.

Types of Systemic Drug Actions. The action of drugs cannot change the function of a cell or cause any cell to produce a new response that does not already exist. Drugs can, however, alter the productivity of a normal or diseased cell, tissue, or organ through their stimulation, depression, irritation, or replacement effect. Drugs may also function to attenuate (weaken) or destroy micro-organisms. Let us look a little closer at the stimulation, depression, irritation, and replacement actions of drugs.

Stimulation. The activity of a tissue or an organ is increased by stimulation. Theophylline, aminophylline, and caffeine stimulate the central nervous tissue. There are many other drugs that stimulate selected tissue within the body. However, it is significant to remember that overstimulation of cells actually results in depression.

Depression. This action of a drug decreases cell function. A drug that decreases the ability of the respiratory center is called a respiratory depressant. Barbiturates (phenobarbital and seconal) are central nervous system (CNS) depressants.

Irritation. This action produces slight temporary damage to tissues. Mild irritation usually results in stimulation of cells, but prolonged irritation causes depression of cellular activity. Marked irritation may initiate an inflammatory reaction and possibly death of the tissue. Castor oil is a mild irritant. A strong acid is a marked irritant.

Replacement. Replacement therapy is a term used to indicate the use of organs or gland secretions in the treatment of deficiency diseases in human beings. In general, it is a therapy of substitution. This type of therapy represents one of the greatest triumphs of modern medicine. For example, estrogens and androgens are a form of replacement therapy for nonavailable normal hormones, insulin, and other similar replacements.

Exercises (297):

1. Match the statements describing the actions in column B with the items in column A.

Column A

_____ (1) Depression.
_____ (2) Irritation.
_____ (3) Replacement.
_____ (4) Stimulation.

Column B

a. This action produces slight temporary damage to tissue.
b. This action decreases the power of the cell to function.
c. The activity of a tissue or organ is increased.
d. It is a therapy of substitution.

298. Given a list of the toxic effects that a drug, medicinal preparation, or compound may have upon the human body, match each with its appropriate definition.

Drug Toxicity. Any drug, medicinal preparation, or compound may have a toxic (poisonous) effect upon the human body. The undesirable effects of some drugs are minimal in the average person; but, in others, these effects can have serious consequences and produce effects ranging from tissue damage to the death of the patient. Some of these undesirable effects appear early; others appear only after prolonged administration of a drug. In some cases, the toxic reaction can be alleviated by adjusting the dosage of the medication. In other cases, the patient must refrain from taking the drug. Occasionally, another drug must be administered to counteract the drug that produces the toxic effect. Following are some of the undesirable effects produced by drugs.

Side effects. This is an effect or action of a drug other than the one for which it is given or intended. The action of a drug may be therapeutic for a medical/dental condition but have a side effect other than the effect we desire to treat that condition. Antihistamines, which are administered for their decongestant action, can also cause drowsiness. This drowsiness is a side effect of the drug.

Untoward effects. When a side effect is, or can be, harmful, it is known as an untoward effect. Morphine at times causes nausea, vomiting, and habituation. Prolonged administration of the antibiotic streptomycin causes destruction of the eighth cranial nerve. Aspirin may cause gastric upset or bleeding in the lining of the stomach. These are not the only drugs with untoward effects. Instead, there are literally hundreds of drugs that can have untoward effects if used improperly or without caution.

Antagonistic effects. When two or more drugs administered to a patient act in opposition to each other—that is, one tends to counteract or neutralize the other in its effect on an organ or tissue—they are antagonistic toward one another. Some drugs are highly valuable for their antagonistic effects. For example, a doctor may use sodium amytal (a barbiturate) to counteract poisoning by strychnine.

Synergistic effects. This is the "working together" effect, the enhancing effect one drug has on another. In the treatment of certain types of dental pain, the combined effects of aspirin and codeine are far greater than the effects afforded by either alone. Naturally, any combination of drugs is effective only when an organism is susceptible to their combined action.

Cumulative effects. Some drugs are excreted so slowly that one dose has not been completely eliminated by the body before the next dose is given. In this way, the drug accumulates in certain body tissues. Sometimes this effect is desired to maintain long-term medication. However, with some medications, if administration continues, it is possible for a toxic effect to occur. Drugs such as mercury, iodides, and digitalis can have this cumulative effect. Ideally, the therapeutic level is maintained without reaching the toxic level.

Idiosyncrasy. This effect refers to an unexpected response to a drug, an effect that differs from that which is normally seen. For example, occasionally a patient becomes excited after an injection of morphine, whereas sedation is the more common response.

Tolerance. This is an acquired resistance to a drug in which the effective dosage level has to be progressively increased to attain the same result produced by the original dose. A drug addict, for instance, must keep increasing the amount of the narcotic he or she takes to obtain the same result as with the original dose.

Habituation. This is the psychological craving for the effect that a drug has on the body. Some people develop a habituation to almost anything. Aspirin, coffee, alcohol, amphetamines, and tranquilizers are common examples.

Addiction. This effect refers to a drug's ability to alter the physiological process within the body. The drug has become essential to the maintenance of ordinary cellular activity. Morphine is well known for its addicting ability. It is important to remember that addiction is a physiological dependence.

Hypersensitivity. This usually refers to an allergic reaction of the body to a drug. Hypersensitivity in its most obvious and severe form is known as anaphylaxis (anna-fl-lack'-sis). An example would be a patient who is allergic to novocaine or penicillin.

Overdose. This is an undesirable effect due to an excessive amount of a drug present in the body. An overdose that causes poisoning is called a toxic dose. One that causes death is call a lethal dose.

Exercises (298):

1. Match the statements in column that are descriptive of specific drug toxicity effects with the effects listed in column A.

Column A

_____ (1) Side effects.
_____ (2) Untoward effects.
_____ (3) Antagonistic effects.
_____ (4) Synergistic effects.
_____ (5) Cumulative effects.
_____ (6) Idiosyncrasy.
_____ (7) Tolerance.
_____ (8) Habituation.
_____ (9) Addiction.
_____ (10) Hypersensitivity.

Column B

a. A drug is excreted so slowly that one dose has not been completely eliminated by the body before the next dose is given.
b. Two drugs having an opposite effect on an organ, tissue, or to each other.
c. An exaggerated reaction of the body to a drug.
d. Psychological craving for the effect that a drug has on the body.
e. An effect or action of a drug other than that for which it is given or intended.
f. Sideeffects that are or can be harmful.

Column A	Column B
	g. Enhancing effects of one drug on another.
	h. Acquired resistance to a drug in which the effective dosage has to be progressively increased to obtain the same result as that produced by the original dose.
	i. Unexpected response to a drug.
	j. Ability of a drug to alter the physiological process within the body.

5-3. Therapeutic Agents

Therapeutics is the science and art of healing. Therapeutic agents are those drugs that are used to treat diseases. These agents may be known by more than one name. They may be identified by a trade name (proprietary name) or by a generic name (nonproprietary name), or by both. This section focuses on these names and the major classifications of drugs. There are several ways to classify drugs. You can classify them according to their use, source, or chemical similarities. Sometimes they are not classified at all, just described therapeutically. For our purpose, we will classify them by their use. It is not our intent to cover all the drugs. Instead, we will cover only the major classifications and a few representative drugs of each class.

299. Specify how therapeutic agents are listed and name the accepted books of reference for drugs.

Trade Names. Trade, or proprietary, names are given to drugs by the manufacturer of the drugs. These names distinguish the drugs produced by one manufacturer from similar drugs produced by another manufacturer. For example, tetracyline, which is an antibiotic, is produced by various drug manufacturers under the names of Achromycin, Panmycin, Polycycline, Stedin, and Tetracyn. Each of these drugs is the same—only their names are different. Manufacturers of drugs advertise their products by the trade names they have given the products (such as Anacin, Valium, etc.) to influence dentists and physicians into prescribing that trade name drug. Once the drug has been prescribed under the trade name, in most states a civilian pharmacist cannot legally substitute a similar drug bearing a different trade name. In the military, however, the pharmacist may dispense the prescribed drug under a different trade name.

Generic Names. The official name of a drug is its generic name. For example, tetracycline is the official name for Achromycin, Panmycin, Polycycline, Stedin, and Tetracyn. The *United States Pharmacopeia* (U.S.P.) and the *National Formulary* (N.F.), the pharmaceutical standards made official by the Food, Drug, and Cosmetic Act, refer to all drugs by their generic name. Further, the Air Force encourages its dentists and physicians to prescribe drugs by their generic names.

Drug Classification. There are several ways to classify drugs. They can be classified according to their use, source, or chemical similarities. Sometimes they are not classified at all, just described therapeutically. For our purpose, we will classify them by their use. There are many sources available to help you find a particular drug. The Council on Dental Therapeutics of the American Dental Association annually publishes *Accepted Dental Therapeutics* (ADT), formerly called *Accepted Dental Remedies* (ADR). The ADT is a compilation of drugs useful in dentistry. Drugs listed must have first met the criteria of the council. The ADT contains the description, dosage, pharmacological action, and therapeutic use of each drug. The *Physician's Desk Reference* (PDR) is another source of information. It provides available prescription information on major pharmaceutical products.

Exercises (299):

1. Who establishes trade names for drugs?

2. What is the official name of a drug?

3. Which two books refer to all drugs by their generic names?

4. Where can you find a compilation of drugs used in dentistry?

300. Specify the qualities required to make an ideal antibiotic and distinguish between the actions and effects of the various antibiotics.

Antibiotics. Some antibiotics are synthetic; however, most antibiotics are substances produced from or by various bacteria, fungi, and actinomycetes. Antibiotics suppress the growth of other organisms (bacterialstatic) and in some instances destroy them. There are literally hundreds of antibiotics, but some are too toxic for use on humans. Some effects are not beneficial to humans. Each has its own possible side or untoward effect and can, in certain circumstances, cause a disturbance in the normal flora that results in an infection. To be an ideal antibiotic, a substance should:

a. Exhibit selective and effective antimicrobial activity, preferably against several pathogenic microorganisms.

b. Have little or no side or untoward effect.

c. Not disturb any vital organ or its function.

d. Not have its effect reduced by the body's fluid, plasma, protein, or enzymes.

e. Be soluble in a variety of solvents and be stable.

f. Be manufactured at a reasonable cost to the patient.

Penicillin. Penicillin and its semisynthetic derivatives are still the most important of the available antibiotics. It is by far the most common drug used for dental infections. Dramatic results have been obtained from its use, even within its narrow spectrum. On a weight basis, penicillin G is one of the most potent antibiotic agents in use today. Some bacteria have become resistant to almost all forms of penicillin; yet, others have remained just as sensitive to penicillin as with their first exposure. For example, Treponema pallidum (syphilis spirochete) is one of the most sensitive organisms to penicillin G. The pneumococcus (which causes pneumonia) is another organism that is very susceptible to penicillin. Organisms that are sensitive to penicillin are not only inhibited from further growth but in some cases are actually killed in adequate concentrations of the penicillins. It has been proved that bactericidal (killing) action is a relatively slow but a continuous process. Increasing the dosage or concentration of penicillin does not accelerate its bactericidal effect. The purpose of increased dosage is to destroy more bacteria at a time, not faster, just more. One essential requirement for the bactericidal action of penicillin is that the bacteria actively multiply. Penicillin causes a lysis (decomposition) of the bacterium's cell wall and interferes with its assimilation of necessary elements to build a new cell wall.

Penicillins are no exception to the rule that any drug can provoke a variety of side and untoward effects. Hypersensitivity is the most common adverse reaction to penicillin. Penicillin is usually given orally in dentistry. Injected reactions to penicillin may include pain, sterile inflammatory reactions, and phlebitis (inflammation of the vein). Injections of penicillin G into a blood vessel can prove fatal to a patient, because penicillin G is insoluble; consequently, it is transported to the lungs where it acts as a pulmonary obstruction. If this becomes extensive enough, death results. When a person is known to be allergic to penicillin, erythromycin is normally the drug used as a substitute.

Streptomycin. When it was observed that certain pathogenic organisms were developing resistance to penicillins, a systematic search was started for an antibiotic that would be effective against the resistant organisms. In early 1944, scientists discovered streptomycin, began clinical trials, and recorded its actions and effects upon humans. In high concentrations, streptomycin has bactericidal qualities; whereas, in low concentrations, it is bacteriostatic. Bactericidal agents destroy bacteria, and bacteriostatic agents inhibit the growth and multiplication of bacteria. Some of the organisms that were originally sensitive to streptomycin are now partially or totally resistant to its effects. Streptomycin is poorly absorbed in the gastrointestinal tract; and when it is given orally, it is almost totally eliminated in the feces. Consequently, intravenous or intramuscular injections are the preferred routes.

Streptomycin, too, is no exception to the rule that all drugs are potentially harmful to humans. It has produced a wide variety of adverse reactions in humans. The most important adverse reaction of streptomycin is that involving part of the central nervous system, particularly the eighth cranial (acoustic or auditory) nerve. Deafness has developed in many individuals when the drug has been administered for more than 1 week. Blurred vision was noted in a few instances when the drug was continued for over 25 days.

Tetracyclines. Tetracyclines are like penicillin and streptomycin; both cause adverse reactions. Burning of the eyes, black coating of the tongue, hypersensitivity, nausea, vomiting, diarrhea, blood dyscrasia, and superinfections are a few of the possible complications that have resulted from the use of tetracyclines. Their use is contraindicated during periods of tooth development, because they may produce disfiguring stains on teeth.

Erythromycin. Erythromycin closely resembles penicillin in its spectrum of antibacterial activity. It may be used with penicillin-allergic patients or when organisms have become penicillin-resistant.

Erythromycin is usually administered orally. If given without a suitable buffer or acid-resistant coating, the drug should be taken a half hour before or two hours after meals.

Exercises (300):

1. Name the six qualities desired for an ideal antibiotic.

2. What action does penicillin have on sensitive organisms?

3. What is an essential requirement for bactericidal action of penicillin?

4. What is the most common adverse reaction to penicillin?

5. What could happen if penicillin G were injected into a blood vessel? Why?

6. What type of action does streptomycin have in high concentrations?

7. What is the most important toxic effect of streptomycin?

8. When is the use of tetracyclines contraindicated? Why?

9. On what type of patient could erythromycin be used?

301. List the function and groups of analgesics, and indicate the representative actions of specific analgesic drugs.

Analgesics. Analgesics are drugs that relieve pain. Some of the drugs used as analgesics have an added function—they also relieve or reduce fever. Usually, analgesics can be divided into two groups—narcotic and non-narcotic analgesics.

Narcotic analgesics. The narcotic analgesics are used to relieve severe pain. They do, however, produce side effects that preclude their long-term use. Morphine sulfate falls into this category. There is probably no drug superior to morphine for the relief of pain. It not only relieves severe pain effectively but acts swiftly. However, morphine is habit forming, depresses breathing, and contracts the pupils of the eyes. These adverse side effects limit the use of morphine. Codeine is another narcotic analgesic that has similar side effects. It does, however, have some distinct advantages over morphine. Codeine is less habitforming; it depresses respiration less than morphine; and, when administered with other drugs (Tylenol or aspirin), it increases their effectiveness. Still another narcotic analgesic is meperidine (Demerol). Meperidine is ideally suited for the relief of pain or for cough suppression. Although meperidine's side effects may include dizziness, sweating, nausea, and vomiting, such side effects are experienced less with meperidine than with codeine or morphine.

Non-narcotic analgesics. Non-narcotic analgesics reduce less severe pain. In addition to their pain-reducing (analgesic) action, most of the drugs in this group also function as antipyretics (fever-reducing agents). These agents are most effective when used for pain that is not of the deep-seated type. Deep-seated pain usually requires administration of a narcotic analgesic. Salicylates (aspirin) are the most representative members of the non-narcotic analgesic group. They relieve pain and reduce abnormally high body temperature in febrile (feverish) patients. As an analgesic, aspirin is the most popular and effective drug against pain that is not of a deep-seated origin. It also has a anti-inflammatory affect. Aspirin is also combined with other agents, such as caffeine and in some cases amphetamines, to relieve pain and produce a calming or relaxing feeling. Frequent, large doses of aspirin are likely to produce a condition known as salicylism, which is characterized by ringing in the ears, mental confusion, and profuse sweating. Allergies to aspirin are quite common and usually occur in the form of urticaria (raised patches and itching of the skin); edema (swelling); anaphylactoidlike (hypersensitive) reactions. As with other drugs, care must be taken when dispensing aspirin. Ulcer patients, in particular, should not be administered aspirin; also patients using aspirin sometimes have problems with clotting. Caution should be exercised prior to dental treatment that might cause any bleeding.

Acetaminophen (Tempra, Tylenol) is a synthetic agent similar to aspirin in action and dose. It is antipyretic but is not anti-inflammatory. It is useful when patients are allergic to aspirin.

Exercises (301):

1. What is the function of analgesics?

2. Which group of analgesics is used to relieve severe pain?

3. What drug is usually thought to be best for the relief of pain?

4. What adverse side conditions limit the use of morphine?

5. How does codeine compare to morphine in regard to its addictive powers?

6. Which narcotic analgesic is almost ideally suited for the relief of pain or cough suppression?

7. Which group of analgesics are most effective for pain that is not of a deep-seated origin?

8. What group of drugs is most representative of the non-narcotic analgesic group?

9. In addition to relieving pain, what other beneficial effect is provided by salicylates?

10. What condition is likely to be produced by frequent large doses of aspirin?

11. For what type of patients is the use of aspirin contraindicated?

12. When would acetaminophen be the drug of choice over aspirin?

302. State the purposes, classifications, and side effects of sedatives and hypnotics.

Sedatives and Hypnotics. Often in the treatment of various disorders and diseases, it becomes necessary to relax the patient or to induce sleep. Agents that are employed for this purpose are termed "sedatives."and "hypnotics". Sedatives allay excitement and activity but do not produce sleep. Hypnotics, also called soporifics or somnifacients, are drugs that produce sleep. With few exceptions, a drug that produces sedation in small therapeutic doses acts as a hypnotic in larger therapeutic doses. Similarly, a hypnotic drug functions as a sedative in smaller therapeutic doses.

Barbiturates are commonly used sedative and hypnotic drugs. These agents induce all levels of central nervous system depression from mild sedation to coma. Adverse reactions of the barbiturates include skin eruptions, photosensitivity, muscle and joint pain, vertigo, headache, nausea, and vomiting. Intravenous injection is the most common route of administration of the barbiturates. However, this method of administration may lead to shock and severe respiratory depression. Many drugs such as alcohol, tranquilizers, antihistamines, and narcotic analgesics will increase the action of barbiturates and could seriously endanger or even claim the life of the patient. Therefore, caution should be exercised if barbiturates are given in conjunction with these other drugs.

The following drugs are frequently used in most Air Force dental clinics. There may be others that are the personal preference of dentists for use in various dental/surgical procedures.

a. Diazepam (Valium) is a fast-acting antianxiety drug administered intravenously; it is used alone or in combination with other drugs for dental therapy lasting less than an hour. Valium is chiefly indicated in dental practice as a psychosedative agent or as a general anesthetic premedicant.

b. Pentobarbital sodium (Nembutal) is a short-acting barbiturate. It is effective in treating conditions where mild sedation is desired, such as preoperative apprenhension and anxiety states.

c. Secobarbital (Seconal) is a short-acting barbiturate. Like many other barbiturates, secobarbital is a useful hypnotic where mild sedation is desirable. It is usually administered orally.

d. Promethazine hydrochloride (Phenergan) is a drug which has sedative effects especially useful in dental procedures. Although promethazine is primarily used in the control of motion sickness, nausea, vomiting, and as an antihistamine, its sedative action is due to a side effect of the drug when given in full therapeutic doses.

Exercises (302):

1. What is the purpose of sedatives and hypnotics?

2. How are barbiturates classified?

3. Describe the adverse reactions that may occur from an intravenous injection of a barbiturate.

4. What drug is primarily used in the control of motion sickness, nausea, vomiting, and as an antihistamine as well as a sedative?

303. Specify the purpose and use of hemostatics, and name the types of hemostatic agents used in dentistry.

Hemostatics. What comes to mind when we think of hemostatics? If we take the word apart and look at it, we have hemo- (blood) and -static (not moving). So, the word means that blood is not moving. In the case of a hemostatic agent, it would act to inhibit blood movement. The most common dental problems with hemorrhage occur following a tooth extraction. When hemorrhaging occurs, the hemostatics commonly used are the absorbable type and the vitamin K therapy type.

Among the more common absorbable hemostatics are gelatin sponge and oxidized cellulose. The gelatin sponge, U.S.P. (Gelfoam), is a pliable, surgical sponge material that absorbs and retains blood until it coagulates and forms a firm clot. Both the oxidized cellulose (Oxycel, Novocell) and the oxidized regenerated cellulose (Surgical) react chemically with the blood, which leads to rapid coagulation. The basic difference between the two products is in the method of their manufacture. All of these products are used in dentistry in about the same way. That is, they are used to pack sockets following tooth extractions and as a sutured implant in oral soft tissues. Absorbable gelatin sponge is normally absorbed within 4 to 6 weeks. Small amounts of the oxidized cellulose types are absorbed in 2 to 7 days, but large amounts may take up to 6 weeks before total absorption occurs.

Normally, vitamin K is derived from bacterial action upon certain ingredients in one's diet. However, when a diet is inadequate or when there is an imbalance of the required bacteria, a person's ability to produce vitamin K is impaired. Since vitamin K is necessary to help the human body in the blood coagulation process, it follows that supplements of vitamin K are sometimes necessary. Patients with a history of blood-deficient coagulation properties are sometimes given vitamin K before surgical operations.

Exercises (303):

1. For what purpose is a hemostatic agent commonly used in dentistry following a tooth extraction?

2. Name the more common absorbable hemostatics used in dentistry.

3. What is the basic difference between the two types of absorbable hemostatics which react chemically with the blood?

4. In what two ways are absorable hemostatics used in dentistry? dentistry.

5. Under what condition might a dental patient be given a vitamin K therapy type of hemostatic prior to surgical operations?

304. List the purpose, types, and administration techniques of dental anesthetics.

Local Anesthetics. Anesthetics are drugs that diminish or eliminate the sensation of pain. While analgesics are administered to relieve pain from an existing condition, anesthetics are administered to eliminate the sensation of pain that might be produced by the operative or surgical treatment of a condition. Local anesthetics eliminate sensation by blocking the peripheral pathways of pain impulses (the nerves). Most analgesics work on the central nervous system.

Topical anesthetics. Topical anesthetics are usually applied with a cotton-tipped applicator or aerosol spray. When they are applied to the area, they produce only superficial anesthesia and are often used before injecting a local anesthetic. They also are used to scale teeth, make impressions, or expose radiographs.

Local injection anesthetics. Local injection anesthetics are used more by the dental profession than by any other profession. The intended result of using local anesthetics is to produce anesthesia in a specific area. Many brands of local anesthetics are available and most of them work in the same way. As a general rule, the dentist injects these anesthetics as close as possible to the area nerve fibers.

Two types of injection procedures are the block and the infiltration. In block anesthesia the dentist injects the anesthetic solution around a nerve trunk between the area to be anesthetized and the brain. An example of this technique is the mandibular block. The dentist deposits the anesthetic agent around the inferior alveolar nerve as it enters the mandibular canal. This injection blocks the transmission of impulses along the mandibular nerve forward of the injection site. The effect does not cross the midline of the mouth.

The dentist gives infiltration anesthesia when it is necessary to anesthetize only a small area of tissue and a minimal number of teeth, or when a nerve block is not desirable. Maxillary teeth and tissues are usually anesthetized by infiltration anesthesia because of the extreme porosity of the maxilla. The dentist injects anesthesia just above the periostium as close to the position of the apex of the tooth as possible.

Ordinarily, two basic kinds of injectable anesthetics are used in the Air Force Dental Service—lidocaine hydrochloride (HCl) and mepivacaine hydrochloride (HCl). Lidocaine HCl (Xylocaine) is available in two forms—ointment for topical use and liquid for injection purposes. The injectable form is available in 1.8 cc carpules (glass-type cartridge) containing a 2-percent solution of lidocaine HCl and varying amounts of vasoconstrictor. Vasoconstrictors are covered later in this chapter.

Mepivacaine hydrochloride (Carbocaine) is available in carpules of 2-percent mepivacaine with a vasoconstrictor, or in 3-percent carpules with no vasoconstrictors. The 1.8-cc standard carpule is used for all Air Force injection anesthetics to fit the syringes designed for this purpose.

Exercises (304):

Identify each true statement and explain why the others are false.

____ 1. Both analgesics and anesthetics are drugs that diminish or eliminate the sensation of pain.

____ 2. Topical anesthetics are often applied before injection of local anesthetics to scale the teeth, make impressions, and expose radiographs.

____ 3. Both basic kinds of injectable anesthetics, lidocaine hydrochloride and mepivacaine hydrochloride, are available in 1.8-cc carpules.

____ 4. Local injection anesthetics are widely used by the dental profession to produce anesthesia in a specified area, so they are injected as close as possible to the area's nerve fibers.

____ 5. A block anesthesia would be the type of injection procedure used by a dentist if he or she desired to limit the area of numbness to a specific maxillary tooth.

____ 6. Anesthetics are administered to relieve pain from an existing condition.

____ 7. The usual method of application of a topical anesthetic is by injection in an area adjacent to nerve fibers.

305. Define vasoconstrictors and tell when they are used in dentistry and give the action and use of antisialagogues.

Vasoconstrictors. As their name implies, vasoconstrictors are drugs that constrict blood vessels. They are particularly effective for constricting the blood capillaries.

Epinephrine. Epinephrine is the most widely used vasoconstrictor in dentistry. When it is applied to a local area, it may act as a hemostatic agent. Its action is similar to that of a tight rubber band around a blood vessel. Epinephrine as a local vasoconstrictor is also used in dentistry. Its main purpose is to prolong the effect of local anesthetics and to to render the area less hemorrhagic. The vasoconstricting action decreases the blood flow in the injection area which, in turn, decreases the absorption rate of the anesthetic. Thus, the slower the anesthetic is absorbed or the longer it stays close to the nerve, the longer its effect. The amount of vasoconstrictor used is determined by the procedure to be accomplished and by the patient's requirement and health history. Some lengthy operations require more prolonged vasoconstriction effect. *Levonordefrin* is another vasoconstrictor that is commonly used in dental anesthetic solutions.

Antisialagogues. Antisialagogues are drugs which reduce the flow of saliva. These drugs are sometimes used on patients who secrete an excessive amount of saliva. This enables the dentist to complete dental operations without the problem of moisture contamination from saliva. Antisialagogues are used only on patients having severe salivary problems, since in addition to making the mouth dry, they cause dryness of the throat and make speaking difficult. Atropine sulfate and scopolamine are representative of the antisialagogues used in dentistry.

Exercises (305):

1. What is the purpose of vasoconstrictors?
2. What is the most widely used vasoconstrictor in dentistry?
3. What effect does epinephrine have on local anesthetic?
4. What drugs are useful in dentistry to reduce exessive secretions of saliva?
5. Give two reasons that antisialagogues are used only on dental patients with severe salivary problems.
6. Name two representative antisialagogues used in dentistry.

306. Identify the action and use of antihistamines.

Antihistamines. Antihistamines are used to combat the body's allergic reaction to certain agents, such as pollens, bee stings and drugs. Medically, antihistamines may be prescribed to counteract conditions such as hives, seasonal hay fever, and drug reactions.

In dentistry, they are generally used to counteract the body's allergic reaction to a drug that has been used during dental treatment. For example, a patient having a mild reaction to a local anesthetic would probably be administered an antihistaminic drug.

Benadryl is the most frequently used antihistamine for such allegic reactions. Benadryl can also be used as a local anesthetic for those patients who are allergic to all other local anesthetics. In addition to Benadryl, the antihistamines with the brand names Chlor-Trimeton and Pyribenzamine are representative of the group. Antihistamines may produce the side effects of sleepiness, drowsiness, dizziness, and disturbance of body coordination.

Exercises (306):

1. Antihistamines are used to combat the body's ______________ reaction to certain agents, such as pollens and drugs.
2. In dentistry, a patient having a mild reaction to a local anesthetic would most frequently be administered the antihistamine ______________ , although Chlor-Trimeton and Pyribenzamine are also frequently used.
3. What side effects may antihistamines produce?

307. Specify the effect on teeth of fluoride in the diet in the correct amount and in an excessive amount, cite the proper proportion in which it should be added to the drinking water and the correct dosage in tablet form, and list the value of fluoride compounds in mouthwashes and in dentifrices.

Fluoride Compounds. The majority of the people in America drink water that contains controlled amounts of fluoride. The presence of small quantities of fluoride in the diet has been found beneficial in substantially reducing the incidence of dental caries in children and young adults. Research has shown that where fluoride dosages are applied in the controlled amounts of about 1.0 part per million (ppm) to the water supply, caries in children is greatly reduced. Currently, water is the most effective and economical means through which small quantities of fluoride can be made available for assimilation into the enamel of the teeth.

It is well known that the dental condition called fluorosis, caused by drinking water containing excessive concentrations of fluoride, can be prevented by removing the excess fluoride from the water supply. If a source of water containing the proper fluoride concentration cannot be substituted for a high fluoride source, defluoridation should be considered. Any fluoride-removal process should not reduce the fluoride content much below 1.0 ppm; so that the beneficial effects of caries inhibitition are retained.

The USAF Surgeon General prescribes the amount of fluoride residual in the water distribution system for each military installation. Because of the greater average intake of water on bases in warm climates, the prescribed fluoride is maintained at a lower level than at those bases in cooler climates. To determine the dosage that gives the desired residual, the natural fluoride content of the raw water must be considered. The desired spread ranges 0.6 to 1.7 ppm of fluoride in the finished water supply, with the average about 1.0 ppm You should refer to the specific regulations that cover the U.S. Air Force policy on fluoridation and defluoridation of base water supplies. The necessary guidelines for setting up such projects are found in AFR 161–9, *Fluoridation and Defluoridation of Water Supplies*.

Fluoride exists in water as ions or as rapidly soluble salts. Both compounds are ingested and enter the bloodstream for utilization during enamel formation. Once systemic fluorides reach the tooth, they affect the enamel, causing a permanent modification of the chemical structure. The hydroxyapatite in enamel takes up the ingested fluoride ions carried in the bloodstream and forms fluorapatite, which is less soluble in decay acids. Thus, systemic fluorides reduce the susceptibility to dental decay.

Another method of administering systemic fluoride is by tablet. One 2.21 mg tablet of fluoride releases 1 mg of active fluoride for absorption by the body. Children should be advised not to drink milk at the same time the fluoride tablet is given. Milk inhibits the absorption of fluoride from the stomach into the body.

A third method of using fluoride is by topical application. This use of fluoride benefits the teeth only after eruption. There are numerous ways the fluoride can be delivered. It may be applied in an aqueous solution after a patient has received an oral prophylaxis. It may also be incorporated into the polishing agent we use in dental prophylaxis. It is an ingredient in many commercial toothpastes.

Exercises (307):

1. Through what means do fluoride compounds in trace quantities greatly reduce caries in children?

2. What condition results from excessive amounts of fluoride in the water supply?

3. Why is the prescribed concentration of flouride in the water supply of southern bases lower than that of northern bases?

4. In terms of parts per million, what is the desired range of fluoride concentrations in base water supply systems?

5. What is the alternative method of administering fluoride in those areas where it is not feasible to add fluoride to drinking water?

6. What regulation specifically covers the Air Force policy on fluoridation and defluoridation?

308. Specify the types and uses of solvents in dentistry.

Solvents. Solvents are substances that are used to dissolve other substances. In dentistry, solvents are used for cleaning purposes and for helping with treatments. Common solvents used for cleaning purposes in dental clinics are orange oil, U.S.P.; alcohol, U.S.P. (ethyl alcohol); and isopropyl alcohol, N.F. The orange oil dissolves zinc oxide and eugenol materials from the hands and face. Alcohols dissolve a variety of substances found on instruments, cabinet tops, etc. Alcohols, in combination with other compounds, are also used as disinfectants.

Chloroform and eucalyptol are solvents sometimes used to aid in treating root canals. Both substances are effective in partially dissolving and softening gutta-percha points before they are inserted as root canal-filling materials. Chloroform containing dissolved gutta-percha is called chloro-percha, and eucalyptol containing dissolved gutta-percha becomes euca-percha.

Exercises (308):

1. For what two general purposes are solvents used in dentistry?

2. Name three common solvents used for cleaning purposes in dental clinics.

3. Name two solvents suitable for partially dissolving and softening gutta-percha points before their insertion as root canal-filling materials.

309. List the use of phenolic compounds in dentistry and specify what precautions should be taken when using phenol.

Phenolic Compounds. Phenolic compounds are used in dentistry for their antiseptic and disinfecting qualities. Camphorated parachlorophenol is the most commonly used phenolic compound. It is used during endodontic procedures to sterilize root canals. Also representative of this group are creosote and thymol. Creosote disinfects root canals during endodontic procedures. Phenol (carbolic acid), itself, is a caustic material. When it is used in any strength, you should have a 50 percent solution of alcohol available to neutralize it in case an accident occurs. Misplaced or spilled phenol could cause severe acid burns to soft tissues.

Exercises (309):

1. What are the uses of the phenolic compounds, cresote and camphorated parachlorophenol?

2. What should you have available as a neutralizer when you are using phenol?

5-4. Therapeutic Aids

Throughout the field of medicine and dentistry, substances are used as aids in the art and science of treating patients. Such substances have little or no medicinal value but simply aid in rendering treatment. This section deals with a few of these therapeutic aids: dentifrices, mouthwashes, and selected physical aids.

310. Given a series of statements concerning the types and the therapeutic value of dentifrices and mouthwashes, determine which are true and which are false.

Dentifrices. Dentifrices are therapeutic aids used in conjunction with a toothbrush to clean the dentition. Dentifrices are available in the form of powder, paste, and semiliquid. Most dentifrices consist of abrasives, flavorings, detergents, and a base vehicle (such as glycerin). Some dentifrices have fluoride compounds added with clinically proven benefits. Tests show that some (not all) fluoride toothpastes used on a regular basis actually aid in reducing the incidence of tooth decay.

While some dentifrices aid in cleaning the teeth, some produce undesirable results. These undesirable results are directly related to the abrasive quality of the dentifrice in most cases. For example, the abrasiveness of some available dentifrices is so high that they can scratch tooth enamel and severely erode the cementum and dentin. Although most people desire clean, white teeth, maintaining them by using highly abrasive toothpastes is unwise.

It is not possible to name a single dentifrice that is suitable for all patients, but recommendations should be based on individual cases. Because of its cleansing ability and relatively low abrasiveness, common baking soda is sometimes recommended for regular use. Also, several brand name dentifrices, Sensodyne, Thermodent, Promice, Protect and Denquel are recommended for patients with hypersensitive teeth. The dental officer usually prescribes usage of the sensitivity type dentifrices for limited periods of time. Thus, dentifrices should be carefully selected to meet the particular needs of each patient.

Mouthwash. There has been considerable debate over the assumed benefits that are derived from mouthwashes. The latest information on the subject comes from Dental Investigation Service, Brooks AFB TX. The 2nd edition of Air Medical Review on infection control states that the use of a mouthwash prior to treatment can reduce the oral flora by as much as 90 percent.

Mouthrinse. Mouthrinses recently appeared on the market. They differ from mouthwashes in that they contain fluoride. In essence, every time you use these mouthrinses you are getting a "mini" fluoride treatment. Their benefits are realized with extended and regular use. But they were not designed to replace the annual topical fluoride treatment.

Exercises (310):

Identify each true statement and explain why the others are false.

____ 1. Most dentifrices consist of a base vehicle, abrasives, detergents, and flavoring.
____ 2. Not all fluoride toothpastes aid in reducing the incidence of tooth decay.
____ 3. Since highly abrasive dentifrices may produce white and clean teeth, they are to be recommended because they produce desirable results.
____ 4. Common baking soda is never recommended as a dentifrice, because its cleaning ability is low and its abrasiveness is high.
____ 5. Laboratory tests conclusively prove that mouthwashes have no effect on oral flora.
____ 6. Mouthrinses offer benefit only through extended and regular use.

311. Specify the types, use, and value of the physical therapeutic aids.

Physical Aids. Other helpful items in the treatment of dental patients are physical aids. The important items that follow were selected because they are frequently misunderstood.

Toothbrushes. Toothbrushes fall into one of two categories—manual or mechanical. That is, they are either the type used solely by hand or the type powered by a small electric motor. There have been many arguments presented as to which category is better. Suffice it to say that the toothbrush to be recommended for dental patients depends upon the merits of individual cases. The type of toothbrush frequently recommended has bristles that are of soft to medium rigidity. This recommended toothbrush also has a multiplicity of tufts equal in length to form a flat brushing surface. Overall, the entire head of the brush is from small to medium in size.

In deciding which toothbrush is best for a particular patient, consider the following points:

- Type of treatment patient is receiving (surgical, periodontal, etc.).
- Patient's present dental condition (normal, gingivitis, etc.).
- Relative size of patient's mouth.
- Patients ability to manipulate a toothbrush.

The best advise to a patient would be to use any toothbrush that cleans effectively and causes no damage to the teeth or gingiva.

Dental flosses. A general description of dental floss might read "a strong thin string or tape of nylon, which is sometimes waxed and is used to clean areas between the teeth." Quite often, the nylon, unwaxed type is the floss recommended.

Although dental floss cleans plaque from only a small portion of the total exposed tooth surfaces, these surfaces are important. In fact, the area cleaned by dental floss is more susceptible to decay and periodontal disease than other areas of the mouth. Stress the importance of using dental floss when you are counseling a patient on effective home care, but be sure to caution against snapping the floss between the teeth. Such action can injure gingival tissues.

Disclosing agents. Disclosing agents are dyes suitable for staining bacterial plaques found on the teeth. For effective cleansing of the entire mouth, it is important to know the areas where bacterial plaques are most likely to persist. The easiest way to do this is to stain the bacterial plaques so that they can be seen. Chewable tablets (called disclosing tablets or wafers) contain a dye that is suitable for this purpose. When chewed and swished between the teeth for about 30 seconds, the dye stains any plaque on the teeth. The dye does not stain clean tooth surfaces or fillings, but it will stain the tongue and lips for up to 2 hours. Staining of the lips can be prevented by coating them lightly with a lubricant such as petroleum jelly.

To assure complete cleansing of the teeth, a patient should inspect the teeth in a mirror with a good light. With a mouth mirror and a regular mirror, the patient can see the lingual surfaces of the teeth. Until the patient has thoroughly mastered the methods for plaque removal, use the disclosing dye after each brushing and flossing to check on the success of the cleaning.

Water-irrigating devices. Water-irrigating mechanisms or hydrodevices are useful in rinsing dislodged or loose oral debris. Their intended use is primarily as an adjunct to normal brushing and flossing. These devices may be of value to most individuals. But they are of particular value in helping to clean areas sheltered by orthodontic appliances, wiring for fractures and periodontal treatment, and splints. A variety of water-irrigated devices is available, but they are not designed to replace routine brushing and flossing for plaque removal.

Interdental stimulators. Interdental stimulators are gingival massaging devices. There are two types available—rubber and wood. The rubber type is sometimes attached to the handle end of a toothbrush. The wood type is a thin triangular wedge. Interdental stimulators should be used with caution. The normal healthy adult obtains the necessary gingival massaging while brushing his or her teeth.

Exercises (311):

1. Although the type of toothbrush recommended depends upon the individual case, summarize a typical recommendation for an average patient.

2. Give four points to consider in deciding which toothbrush is best for a patient.

3. When briefing a patient concerning the use of dental floss, why should you caution against snapping the floss between the teeth?

4. What two types of mirrors should a patient use to assure complete cleansing of bacterial plaque stained with the disclosing agent (dye) method?

5. What type of physical aid would be of particular value in helping to clean areas sheltered by orthodontic appliances?

6. Are interdental stimulators recommended for all normal healthy adults? Why?

Bibliography

ECI Course

CDC 98150, Volume 2, *Basic Dental Sciences*, Volume 3, *Dental Instruments and Materials*. Extension Course Institute, Gunter Air Force Station, Alabama, 36118.

Books

Torres and Ehrlich, Modern Dental Assisting, 2nd ed. W. B. Saunders Company, West Washington Square, Philadelphia, Pennsylvania, 1980.

Aeromedical Review, Review 3-80, Infection Control In Air Force Dental Clinics, USAF School of Aerospace Medicine, Aerospace Medical Division (AFSC), Brooks Air Force Base, Texas.

ANSWERS FOR EXERCISES

CHAPTER 1

Reference:

200 − 1. The external cell membrane.
200 − 2. Digestion and respiration.
200 − 3. Nucleus.
200 − 4. a. Prophase—the nuclear membrane disappears. Centrioles located within the centrosome become active and form spindles.
  b. Metaphase—chromosomes produce enzymes, which control chemical reactions in the cell and are the blueprint for a organism, and and pull to the center of the cell. The chromosomes then duplicate themselves.
  c. Anaphase—the two groups of chromosomes separate.
  d. Telophase—a nuclear membrane develops around the new cells and finally the daughter cells separate.
  e. Interphase − no division processes take place.
200 − 5. Ameloblasts—form enamel.
  Osteoblasts—form bone.
  Odontoblasts—form dentin.
  Clasts—destroy tissues and substances.
  Neurons—transmit impulses.
  Phagocytes—engulf foreign matter in the body.
  Glandular—secrete chemical substances.
  Erythrocytes—transport substances from one part of the body to another.

201 − 1. (1) c.
  (2) d.
  (3) f.
  (4) b.
  (5) e.
  (6) g.
  (7) a.

202 − 1. Five to 6 quarts.
202 − 2. (1) Red blood cells—the exchange of oxygen and carbon dioxide via hemoglobin.
  (2) White blood cells—fight infection.
  (3) Platelets—coagulate blood.
202 − 3. Clear liquid, composed of 92 percent water, proteins, carbohydrates, fats, vitamins, hormones, enzymes, and chemical salts.
202 − 4. Platelet disintegration, plus tissue fluid, yields thromboplastin. Thromboplastin, plus calcium ions and prothrombin, yields thrombin. Thrombin, plus fibrinogen, yields fibrin clot.

203 − 1. T.
203 − 2. F. It also supports the organs and furnishes a place of attachment for muscles.
203 − 3. F. It permits motion and propulsion of the body.
203 − 4. T.
203 − 5. F. It removes oxygen from inhaled air and gives off carbon dioxide produced by cells of the body.
203 − 6. T.
203 − 7. T.
203 − 8. F. It gives the body awareness of its environment and enables it to react to stimuli from that environment.
203 − 9. T.

204 − 1. T.
204 − 2. F. The dermis is the true skin.
204 − 3. T.
204 − 4. F. The dermis also contains sebaceous glands.
204 − 5. T.
204 − 6. T.
204 − 7. F. One liter is normally excreted each day.
204 − 8. T.
204 − 9. T.

205 − 1. 206.
205 − 2. a. Long—femur, humerus; b. short—wrist, ankle; c. flat—skull, sternum, scapula; and d. irregular—vertebrae, mandible, pelvis.
205 − 3. Manufacture of red blood cells and certain white blood cells.
205 − 4. Compact bone.
205 − 5. Periosteum.
205 − 6. 2/3 mineral matter (lime salts); 1/3 organic matter (protein).

206 − 1. One-half.
206 − 2. Circulation of the blood, respiration, and digestion.
206 − 3. 500.

207 − 1. Voluntary and involuntary.
207 − 2. (1) Origin, (2) belly, and (3) insertion.
207 − 3. Voluntary.
207 − 4. Involuntary.
207 − 5. Cardiac.

208 − 1. (1) g.
  (2) n.
  (3) k.
  (4) l.
  (5) i.
  (6) c.
  (7) d.
  (8) j.
  (9) m.
  (10) h.
  (11) e.
  (12) b.
  (13) a.
  (14) f.

209 − 1. By carrying oxygen from the lungs to the cells and carbon dioxide from the cells to the lungs.
209 − 2. By aiding in the defense against injurious agents by means of immune substances and white blood cells.
209 − 3. Systemic circulation.

210 − 1. (1) b.
  (2) d.
  (3) c.
  (4) a.
  (5) e.

211 − 1. Bloodstream.
211 − 2. Tissue; blood plasma.
211 − 3. By the contraction of the smooth muscles on the vessels and by the massaging action of the skeletal muscles.
211 − 4. Contaminants.
211 − 5. The spleen, the thymus, and the tonsils.

212 − 1. (1) Nose, (2) pharynx, (3) larynx, (4) trachea, (5) bronchi, (6) lungs, and (7) pleurae.
212 − 2. It is warmed, moistened, and filtered.
212 − 3. It permits the equalization of air pressure between the middle ear and the outside atmosphere.
212 − 4. The larynx moves upward and forward, placing it under the base of the tongue. This causes the epiglottis to move backward and downward, directing the food into the esophagus.
212 − 5. Entrap dust and foreign matter.
212 − 6. The lung.
212 − 7. The visceral and the parietal.
212 − 8. It reduces friction between the two pleural layers during the movements of respiration.

213 − 1. F. The muscles of respiration contract.
213 − 2. T.
213 − 3. T.
213 − 4. F. It is an involuntary act controlled by the nervous system.
213 − 5. F. They originate in the cells of the respiratory center.
213 − 6. T.

214 − 1. It lies behind the trachea and in front of the vertebrae. It extends from the end of the pharynx to the stomach.
214 − 2. The upper left quadrant just below the diaphragm.
214 − 3. It stores and digests food.
214 − 4. It serves as a cushion and storage place for fat and prevents the spread of infections.
214 − 5. The duodenum.
214 − 6. The ileum.
214 − 7. It is a one-way value that controls the passage of materials into the cecum from the ileum.
214 − 8. A strong muscular ring called the anal sphincter.

215 − 1. (1) c.
(2) d.
(3) c.
(4) a.
(5) c.
(6) b.

216 − 1. Afferent, which is receptive or sensory; efferent, which is effective or motor.
216 − 2. To carry impulses from the periphery toward the spine and brain.
216 − 3. To carry impulses from the spine and brain to the periphery.

217 − 1. T.
217 − 2. T.
217 − 3. F. The frontal lobe is a motor area.
217 − 4. T.
217 − 5. F. It is the second largest part of the brain.
217 − 6. T.
217 − 7. T.
217 − 8. F. It contains 31 pairs of spinal nerves.

218 − 1. (1) d.
(2) f.
(3) b.
(4) c.
(5) e.
(6) g.
(7) a.
(8) i.
(9) h.

219 − 1. F. They lie on the posterior abdominal wall.
219 − 2. T.
219 − 3. F. About 4 cm long.
219 − 4. T.
219 − 5. F. Filtration and reabsorption.
219 − 6. T.

220 − 1. Sensation, protection.
220 − 2. Responsible for the lubrication of the surface of the skin.
220 − 3. Nervous and chemical activation of sweat glands and by dilation and contraction of capillary vessels.

221 − 1. Medulla of the adrenal.
221 − 2. Thyroid.
221 − 3. To regulate the calcium and phosphorus content of the blood.
221 − 4. The destruction or malfunction of the islets of Langerhans.
221 − 5. Gonads (testes).

222 − 1. Testes.
222 − 2. Cowper's glands.
222 − 3. Prostate gland.
222 − 4. Ejaculatory duct.
222 − 5. Spermatic cords.
222 − 6. Seminal vesicles.

223 − 1. (1) d.
(2) h.
(3) i.
(4) a.
(5) j.
(6) e.
(7) f.
(8) g.
(9) b.
(10) c.

224 − 1. Mucous secretion.
224 − 2. Alkaline secretion of the prostate.
224 − 3. Fallopian tube.
224 − 4. Vas deferens.
224 − 5. It is expelled during the menstrual cycle.

225 − 1. Anything that occupies space and has weight or mass.
225 − 2. Mass, weight.
225 − 3. Energy.
225 − 4. Created, destroyed.

226 − 1. Solids, liquids, and gases.
226 − 2. A change in temperature or pressure easily pushes the particles farther apart or closer together.
226 − 3. Liquids have a definite volume at a given temperature and take the shape of the container in which they are placed.
226 − 4. Solids may expand or contract slightly upon normal heating or cooling.

227 − 1. (1) b.
(2) a.
(3) a.
(4) b.
(5) b.
(6) a.
(7) a.
(8) b.
(9) b.

228 − 1. Elements, chemical, physical.
228 − 2. Atoms; characteristics.
228 − 3. Hydrogen; uranium.
228 − 4. Structured.
228 − 5. Proton; electron.
228 − 6. Protons; positive.
228 − 7. Electrons.
228 − 8. Protons.
228 − 9. Neutrons.
228 − 10. Isotopes; protons; electrons; neutrons.

229 − 1. Compounds are substances of fixed composition that result from the chemical union of two or more elements.
229 − 2. The molecule.

230 − 1. The number of electrons it needs to borrow, lend, or share to complete its outer orbit.
230 − 2. Combination.
230 − 3. Decomposition is the breaking up of a more complex substance into a simpler substance.
230 − 4. Radicals.
230 − 5. Either as a result of natural combination, of electrolysis, or by other chemical changes.
230 − 6. The exchange of atoms or radicals between different substances.

231 − 1. Acids—substances containing hydrogen that donate hydrogen ions in solution.

Bases—proton acceptors; when dissolved in water, they form no negative ions other than OH ions.
Salts—ionic compounds formed by the replacement of part or all of the acid hydrogen of an acid by a metal or a radical acting like a metal.

231 – 2. Acids—are usually classified according to the number of protons furnished by each molecule. Bases are usually classified according to the number of protons they accept.

231 – 3. Acids have a sour taste, affect some indicators, neutralize bases to form salts, react with some metals to form salts, react with some metallic oxides to form salts, react with carbonates to form carbon dioxide and water, and are usually soluble in water. Bases have a bitter taste in solution, feel slick and slippery like soap, affect some indicators, react with acids to form salts, and react with nonmetallic oxides to form salts.

231 – 4. (1) Strong acid and strong base.
  (2) Weak acid and weak base.
  (3) Strong acid and weak base.
  (4) Weak acid and strong base.
  Reactions (1) and (2) result in neutral salts. Reactions like (3) result in acidic salts, which produce acidic solutions. Reaction (4) results in basic salts, which produce basic solutions.

232 – 1. a. Presence of hydrogen.
  b. A scale used to related changes in hydrogen concentration. "0" is most acidic and 14 most basic.
  c. Solution that does not change pH when a large amount of hydrogen or hydroxyl ions is added.
  d. Process of providing the needed energy to an atom to cause it to lose or gain electrons.

233 – 1. One that dissolves in water or a similar substance.
233 – 2. A mixture in which the compounds do not dissolve when placed in water or a similar substance.
233 – 3. (1) There is no chemical union between the compound and the medium in which it is dissolved or suspended; (2) within certain limits, the proportions in which the components are present may vary; and (3) the particles can be physically separated from the medium.
233 – 4. Osmosis.

234 – 1. Volume; weight.
234 – 2. 10.
234 – 3. Volume; water.
234 – 4. Length.
234 – 5. Liter, gram.
234 – 6. I, F, C.

235 – 1. Bacteria, viruses, rickettsiae, spores, protozoa, and fungi.
235 – 2. The shape of the bacteria, the way the cells are arranged or grouped together, and their reaction to the Gram stain.
235 – 3. a. Cocci.
  b. Bacilli.
  c. Spirochetes or spirilla.
235 – 4. Diplococci.
235 – 5. Streptococci.
235 – 6. Binary fission.
235 – 7. A capsule.
235 – 8. It is a hairlike appendage that whips back and forth to create the movement of some bacteria.
235 – 9. A spore.
235 – 10. The proper environment to survive.
235 – 11. A group of ultramicroscopic, disease-causing agents.
235 – 12. Viruses.
235 – 13. By insects such as fleas, lice, mites, or ticks.
235 – 14. Rocky Mountain spotted fever and typhus.
235 – 15. Protozoa.
235 – 16. Protozoa.
235 – 18. The fungi. Superficial infections that grow on the skin and more serious infections where fungi invades the lungs and other tissues of the body.
235 – 19. Because they lack chlorophyll, and therefore the ability to convert carbon dioxide, water, and sunlight into sugars.

236 – 1. F. Plants.
236 – 2. T.
236 – 3. T.
236 – 4. T.
236 – 5. F. Damage is usually not permanent and rarely results in death of the host.
236 – 6. F. They grow only in the absence of oxygen.
236 – 7. T.
236 – 8. F. They are Gram-negative.
236 – 9. T.
236 – 10. F. Striplococci have been implicated in the caries process.
236 – 11. T.
236 – 12. T.
236 – 13. T.
236 – 14. T.
236 – 15. F. They divide into two bacteria.
236 – 16. T.

237 – 1. Preventing the transmission of infectious disease.
237 – 2. Bacterial spores, serum hepatitis virus, and tubercle bacillus.
237 – 3. To help reduce the possibility of contamination and cross-infection.

238 – 1. Sepsis means the presence of disease-producing micro-organisms, and asepsis means the condition of being free from pathogenic micro-organisms.
238 – 2. All forms of life are completely destroyed in a circumscribed area.
238 – 3. All instruments that will penetrate, or are likely to penetrate, the soft tissue.
238 – 4. Instruments should be thoroughly scrubbed with a stiff brush, running water and detergent. Then they should be completely rinsed and drained.
238 – 5. It depends on the fact that the boiling point of water increases with pressure.
238 – 6. 15; 121.
238 – 7. The steam will be superheated but not saturated.
238 – 8. At weekly intervals, light scale may be removed with soap and a stiff brush; heavier scale requires the addition of one-half cup of vinegar to the water in the autoclave reservoir and then operation of the unloaded empty autoclave through a regular sterilizing cycle and then removal of the vinegar water.
238 – 9. Sterilization time is reduced; carbon steel instruments will not corrode (provided instruments are dry when placed in the chamber); and instruments are dry at the end of the cycle.
238 – 10. Operate the unit in a well-ventilated area, open the door at arm's length, and stand back for 10 seconds before approaching the sterilizer to remove instruments. When not in use, the chamber door should be closed, but not latched, to increase the life of the door gasket.
238 – 11. Paper bags, plastic/paper bags, nylon tubing, and cloth.
238 – 12. It will sterilize instruments without causing rust and corrosion.
238 – 13. Be careful what materials you place in the oven and remember that an instrument is hot enough at sterilizing temperatures to give severe burns if touched.
238 – 14. To sterilize small instruments such as root canal instruments at the dental chair.
238 – 15. (1) Biological spore tests (strips, ampules—these strips or ampules are placed inside a centrally located pack to check the operation of the sterilizer. The strip is sent to a laboratory for culturing, or the ampule is placed in a small incubator in the dental clinic; (2) chemical indicators (strips, cards, labels)—change colors when exposed to a certain temperature range, but they do not guarantee sterilization; and (3) process indicators (tape, bags with heat-sensitive printing)—lines on the tape and the printing on the bag will darken after exposure to certain temperature ranges.
238 – 16. Before or after they are removed from the autoclave.
238 – 17. How it is wrapped.
238 – 18. Resterilize the pack.

239 – 1. Disinfection is a heat or chemical process by which microbial life is destroyed.
239 – 2. A bacteriostatic agent is one which inhibits microbial reproduction but does not kill the population. A bactericide decimates the microbial population.
239 – 3. An antiseptic is a chemical which is brought into contact with living tissue, the skin or mucous membranes, to inhibit or destroy the microbial population.

239 – 4. Boiling water and chemical disinfectants.
239 – 5. (1) b.
(2) d.
(3) d.
(4) a.

240 – 1. Dilution, time of exposure, temperature, pH, objects to be disinfected, organic matter, and type of micro-organisms.
240 – 2. Instrument disinfection,, skin disinfection and general surface disinfection.
240 – 3. Of a composition not affected by the agent of choice such as Pyrex, glass, and stainless steel.
240 – 4. Frequently. To maintain proper concentrations and to reduce the possibilities of cross-contamination.
240 – 5. Fungi, viruses, and bacteria, including mycobacterium tuberculosis and spores.
240 – 6. 60 to 95 percent.
240 – 7. It is volatile; requires strong concentrations; no sporicidal power; and can be inactivated by blood and other high protein organic matter.
240 – 8. It is more effective, even against TB and hepatitis viruses.
240 – 9. A disinfectant and deodorant.
240 – 10. Following each patient visit.
240 – 11. No. Their antimicrobial activity is limited.

CHAPTER 2

241 – 1. (1) e.
(2) c.
(3) a.
(4) d.
(5) a.
(6) b.
(7) f.
(8) f.
(9) c.
(10) d.
(11) e.
(12) c.

242 – 1. Zygoma.
242 – 2. Thinnest; most fragile.
242 – 3. Frontal, ethmoid, and maxillary.
242 – 4. Back; horizontal.
242 – 5. Outer walls.
242 – 6. Vomer.
242 – 7. Maxillary; teeth.
242 – 8. Zygomatic, frontal, alveolar, palatine.
242 – 9. Alveolar process.
243 – 10. Infraorbital.
242 – 11. Rami.
242 – 12. Genial tubercles.
242 – 13. Lingual.
242 – 14. Coronoid; condyloid.
242 – 15. Sliding hinge; glenoid; temporal.
242 – 16. Temporomandibular.
242 – 17. Lingual; sphenoid.

243 – 1. They act to raise the lower jaw, thereby exerting pressure on the teeth, particularly in the posterior region.
243 – 2. The origin is the entire length of the outer surface of the zygomatic process of the maxilla and zygomatic bone.
243 – 3. A wide area on the sides of the head, including the lower part of the parietal bone, the greater part of the temporal bone, the outer wing of the sphenoid bone, and the lateral surface of the frontal bone.
243 – 4. It is used to raise and to retract the mandible.
243 – 5. Its insertion is at the angular position of the mandible.
243 – 6. It has its origin from two separate heads; the superior head arises from the lower part of the lateral surface of the great wing to the sphenoid, and the inferior head from the lateral surface of the lateral pterygoid plate.
243 – 7. It pulls the head of the mandible forward and inward.
243 – 8. To compress the cheeks.
243 – 9. Closing of the oral cavity opening and protruding of the lips.
243 – 10. On the superior border of the hyoid bone.

244 – 1. Under the superficial tissue of the head and neck.
244 – 2. The seventh cranial nerve.

245 – 1. Supplies sensation to the tissues around the eye and the adjacent parts of the nose and forehead.
245 – 2. The posterior superior alveolar branch.
245 – 3. The lingual gingiva of the maxillary arch and the palate.
245 – 4. It supplies motor impluses to all the primary muscles of mastication.
245 – 5. The tongue.
245 – 6. Temporal, zygomatic, buccal, mandibular, and cervical.

246 – 1. Arteries, capillaries, veins.
246 – 2. Oxygenated.
246 – 3. Common carotid.
246 – 4. Lingual artery.
246 – 5. Inferior alveolar.
246 – 6. Posterior; molar; biscuspid.
246 – 7. Internal.
246 – 8. Pterygoid plexus.

247 – 1. To combat bacterial infections by transporting disease-producing organisms to the lymph nodes and to act as a supplement to the venous system.
247 – 2. (1) The difference in pressure at the two ends of the system; (2) the valves in the lymph vessels, which prevent the backflow of the lymph; and (3) the contraction and relaxation of the muscles.

248 – 1. (1) a.
(2) g.
(3) b.
(4) d.
(5) c.
(6) e.
(7) f.
(8) f.
(9) c.
(10) d.

249 – 1. Between the lips, cheeks, and teeth.
249 – 2. To force the food between the teeth from the facial side during mastication.
249 – 3. The posterior boundary of the cheek connecting the upper and lower alveolar processes in the space behind the last tooth.
249 – 4. By providing a working surface for the tongue to make food into a ball for swallowing.
249 – 5. It hangs from the free border of the soft palate.
249 – 6. It vibrates during speaking to give the voice its resonance.
249 – 7. The mouth proper.
249 – 8. They lie in the cheeks just in front of the ear.
249 – 9. Opposite the maxillary second molars.

250 – 1. (1) c.
(2) a.
(3) d.
(4) e.
(5) h.
(6) i.
(7) q.
(8) j.
(9) f.
(10) j.
(11) k.
(12) b.
(13) g.

251 – 1. Periodontium.
251 – 2. To hold the teeth in a semirigid state.
251 – 3. Support, sensation, nutrition, and formation.
251 – 4. Alveolar crest group.
251 – 5. The oblique group.
251 – 6. Cortical bone.
251 – 7. It is a porous, spongy bone composed of a network of narrow spaces and spicules.
251 – 8. Free gingiva and attached gingiva.

251 – 9. Alveologingival fibers.

252 – 1. (1) g.
(2) c.
(3) i.
(4) a.
(5) b.
(6) e.
(7) d.
(8) h.
(9) f.

253 – 1. F. There are 20 deciduous teeth.
253 – 2. T.
253 – 3. T.
253 – 4. F. It has two antagonists in the opposing arch.
253 – 5. T.
253 – 6. F. They are called posterior teeth.
253 – 7. T.
253 – 8. T.
253 – 9. T.
253 – 10. F. The mesial and distal surfaces of two adjoining teeth are always adjacent.
253 – 11. T.
253 – 12. T.

254 – 1. Any three of the four responses listed below will suffice. relationship to the size of the mouth; (2) They act as an aid in the acquisition of speech; (3) They serve as guides for the developing permanent teeth; or (4) The integrity of the permanent arch depends upon the care given the primary teeth.
254 – 2. The growth of the jaws and the approach of the permanent teeth from the lingual side.
254 – 3. Primary teeth are smaller than the permanent teeth; the enamel is thinner and the pulp chamber is relatively larger, the crowns are milk-white in color and appear to be short and squat, when compared with the permanent teeth.
254 – 4. The primary maxillary second molar.
254 – 5. The primary mandibular first molar.
254 – 6. The exfoliation or shedding process of the primary teeth takes place between the 5th and 12th yearss. This shedding process is caused by the resorption of the roots by osteoclast that have differentiated from the cells of the loose connective tissues.

255 – 1. Mamelons are rounded eminences located where each labial lobe terminates incisally.
255 – 2. The incisal edges of maxillary incisors have a lingual inclination while those of the mandibular incisors have a labial inclination.
255 – 3. Cutting and tearing.
255 – 4. The maxillary first bicuspid has a well-formed, lingual cusp and its buccal cusp is long and sharp, assisting the cuspid as a tearing tooth. The maxillary second bicuspid has cusps that are less sharp and these intercusp with opposing teeth when the jaws are brought together. This makes them more efficient as grinding teeth.
255 – 5. (1) c.
(2) b.
(3) a.
(4) e.
(5) d.

CHAPTER 3

256 – 1. It is an invisible enemy that often causes oral damage before the patient is aware of its presence.
256 – 2. It is a gelatinous, sticky substance composed mostly of water and approximately 20 percent bacteria. It also contains mucin, desquamated cells, leukocytes, and red blood cells.
256 – 3. They are acid-producing bacteria. These acids attack the tooth and decalcify the mineral out of the enamel.
256 – 4. It manifests itself as a white, chalky spot.
256 – 5. Gingival and periodontal diseases.
256 – 6. How long plaque has been in the mouth.
256 – 7. Coccal and bacillary short rod forms.
256 – 8. Vibrios and spirochetes.

257 – 1. Supragingival.
257 – 2. Cream and yellow.
257 – 3. Claylke or bricklike.
257 – 4. Through staining by blood pigments.
257 – 5. 6 to 15 percent.
257 – 6. Calcium, carbonates, phosphates, sodium, trace minerals, and other salts.
257 – 7. At least 3 to 4 days old.
257 – 8. It begins in the layers of plaque next to the tooth.
257 – 9. The precipitation of minerals in the saliva.

258 – 1. Intrinsic and exogenous stains.
258 – 2. It is usually the result of a high concentration of flouride in the drinking water during tooth formation in childhood.
258 – 3. On the outside surface of the teeth.
258 – 4. Orange, green, gray, and brown.
258 – 5. Extrinsic stains that become intrinsic stains.

259 – 1. Rubor is a vascular response that causes the redness to appear in the area of the inflammation.
259 – 2. Calor is a vascular response caused by increased blood supply. The increased flow of blood raises the temperature of the inflammed area of the skin.
259 – 3. Tumor is a humoral and cellular response. Swelling in the area of inflammation is due to accumulated fluids and engorged blood vessels.
259 – 4. Dolor is pain that warns us when something is wrong. The accumulation of materials irritates sensory nerves and causes local pain.
259 – 5. Functio laesa is the loss of function or altered function caused by damaged or injured tissue, plus swelling.
260 – 1. (1) d.
(2) b.
(3) a, c.
(4) a, b.
260 – 2. By edema or swelling.
260 – 3. By a fibrous growth (hyperplasia) at the site of irritation.

261 – 1. Bacteria.
261 – 2. All dental caries begin when plaque deposits on tooth surfaces become laden with bacteria.
261 – 3. The acidogenic theory.
261 – 4. Dental plaque.
261 – 5. Caries that begin in the enamel and then stop for some unknown reason.
261 – 6. As a leathery or cheesy mass.
261 – 7. The secondary dentin acts as a protective lining or insulator for the pulp tissues.
261 – 8. Sensitivity to cold foods or liquids.
261 – 9. By dental restorations.
261 – 10. Reduction of carbohydrates decreases the bacterial count, thereby reducing caries incidence.
261 – 11. Raw vegetables and some fruits have a cleansing effect by removing some food particles from the teeth, in addition to having a low unrefined (natural) sugar content.
261 – 12. Only while the teeth are forming.

262 – 1. Inflammation of the pulpal tissues.
262 – 2. Extensive tooth decay.
262 – 3. An inflammatory condition of the pulp chamber due to a systemic disease; it is a secondary effect of a more prominent disease of the body.
262 – 4. A dull, obscure pain, usually no pain with percussion and very little pain with heat.
262 – 5. The pulp may die.
262 – 6. By removing the irritant and inserting a sedative filling.
262 – 7. The necrotic pulp may be removed and replaced with a suitable root canal filling material, or the tooth must be extracted.

263 – 1. A localized collection of pus in a cavity, formed by the disintegration of tissue.
263 – 2. Either an acute or a chronic periapical abscess is formed when there is a localized collection of pus at the apex of a tooth.
263 – 3. The acute periapical abscess area becomes extremely painful; this pain increases when heat is applied but decreases when cold is applied. Generally, the chronic periapical abscess is less

painful, occurring only when pressure (in a certain direction) is applied. With the acute periapical abscess, the surrounding tissues become swollen or red; but with the chronic periapical abscess, there is little redness or swelling.
263 − 4. By draining.
263 − 5. It usually stems from a foreign body irritant that becomes embedded in the space between the tooth and the soft tissue or completely within the soft tissue adjacent to the tooth.
263 − 6. Heat or cold causes no particular increase in the pain.
263 − 7. Normally, the onset of cellulitis is signified by edema of the soft structures, severe pain and throbbing, high fever, rapid pulse and headaches, and trismus of the involved masticatory muscles.

264 − 1. This is an inflammation around the crown of the tooth.
264 − 2. As the bacteria multiply, an infectious process is initiated.
264 − 3. A condition where the patient has difficulty opening their mouth because the muscles are aggravated by mechanical trauma or a secondary bacterial infection.
264 − 4. Fever and generalized cellulitis.

265 − 1. Some irritant that usually can be identified.
265 − 2. Around retained roots or any foreign chronic irritant that may be buried in the tissue.
265 − 3. It gradually turns to a clear liquid.
265 − 4. Cells that were left behind after performing a particular function.
265 − 5. A mass of granulation tissue usually surrounded by a fibrous sac.
265 − 6. A chronic inflammation of the periapical tissues.
265 − 7. At the apex of the root and the membrane that surrounds the granuloma.
265 − 8. The tooth may be sensitive to percussion and feel slightly elongated; also, there may be a dull, but persistent pain.
266 − 1. Inflammatory and degenerative.
266 − 2. (1) b.
(2) a.
(3) b.
(4) b.
(5) a.

267 − 1. It is an inflammation of the gingiva.
267 − 2. Accumulation of plaque, a calculus, mechanical irritants, and rough or sharp tooth edges caused by caries.
267 − 3. Swollen, smooth, shiny, and a bright red.
267 − 4. Early elimination of etiological factors.
267 − 5. A dental officer and/or physician.
267 − 6. Epilepsy.
267 − 7. Hyperplastic gingivitis.
267 − 8. The gingiva is enlarged, edematous, and red or bluish red.
267 − 9. Usually by removal of any irritants and good oral hygiene.
267 − 10. There are numerous areas of the gingiva where the epithelium lifts off, leaving large raw patches. Vesicles or blisters appear and rupture. It is a very painful condition.
267 − 11. The tissue is either dead or dying. The gingiva is swollen, red, and bleeding. The dead or dying interdental papilla is covered with a gray-white pseudomembrane. A fetid odor always is present. With the acute stage, the patient has fever, painful gums, and the cervical lymph glands are swollen. The patient suffers from malaise.
267 − 12. Vibrio, bacillus, and spirochete bacteria.
267 − 13. Reassure the patient.
267 − 14. Gentle debridement.

268 − 1. An inflammation of the periodontium, including both the gingiva and tooth attachment apparatus.
268 − 2. Low resistance, fatigue, stress, diabetes, blood problems, and hormone imbalance.
268 − 3. Horizontal loss of bone and cupping-out of interproximals.
268 − 4. Gingival surgery and possibly osseous surgery.

269 − 1. An uncommon occurrence of a nonspecific, noninflammatory, degeneration of the periodontium.
269 − 2. A widening of periodontal spaces, loss of lamina dura, and bone loss.
269 − 3. The second stage.
269 − 4. Progressive gingival inflammation, trauma from occlusion, deeper periodontal pockets, and increased bone loss.

270 − 1. (1) i.
(2) a.
(3) c.
(4) e.
(5) j.
(6) k.
(7) g.
(8) b.
(9) h.
(10) f.
(11) d.
(12) l.
(13) m.

271 − 1. (1) h.
(2) e.
(3) i.
(4) f.
(5) a.
(6) b.
(7) c.
(8) d.
(9) g.
(10) j.

272 − 1. (1) g.
(2) a.
(3) d.
(4) e.
(5) j.
(6) b.
(7) f.
(8) c.
(9) i.
(10) h.
(11) l.
(12) k.
273 − 1. After an extraction if a normal blood clot fails to form or is dislodged.
273 − 2. After the third day.
273 − 3. That a portion of the alveolar bone is exposed and infected. The socket usually has a pungent odor, and the surrounding tissue is inflamed.
273 − 4. Irrigating the pocket with warm saline solution and packing the pocket with iodoform gauze saturated in eugenol. Sedatives and/or analgesics may be prescribed to relieve pain and possible insomnia.

274 − 1. T.
274 − 2. T.
274 − 3. F. If specific signs and symptoms are noticeable, patients should be considered fracture patients until determined otherwise.
274 − 4. F. Bruising and the escape of blood under the skin are generally indicative of blows severe enough to break bone.
274 − 5. T.
274 − 6. F. Diplopia may occur if the bones forming the floor of the orbit are involved.
274 − 7. T.
274 − 8. T.
274 − 9. T.

275 − 1. Thermal and chemical.
275 − 2. Thermal.
275 − 3. By keeping heated instruments and materials out of the operating area until they are in a safe temperature range.
275 − 4. By placing an aspirin tablet in the mucobuccal fold next to the tooth that hurts.

275 – 5. That it should be swallowed to give the beneficial effect desired.
275 – 6. a. Know the content of all medicament bottles in the operatory; b. be able to describe the properties and precautions necessary for handling, neutralizing and storing these substances; c. label all containers; d. make positive identification of all drugs and chemicals; and e. be very careful in handling all chemicals.

276 – 1. (1) b.
(2) a.
(3) b.
(4) b.
(5) a.
(6) c.
(7) c.

CHAPTER 4

227 – 1. T.
277 – 2. F. Nonmetallic materials tend to deteriorate, and even metallic restorations will discolor and corrode.
277 – 3. T.
277 – 4. F. The material is nontoxic; both organic and inorganic matter are involved, the surfaces have imperfections, irregularities, and debris, and the mouth has a normally wet atmosphere.
277 – 5. T.
277 – 6. T.
277 – 7. F. Few dental materials are totally inert or completely harmless to the individual and to the dental tissues.
277 – 8. T.
277 – 9. F. It takes only a matter of seconds.
277 – 10. T.

278 – 1. Tensile force pulls and stretches material, compressive force pushes it together, and shearing force tries to slice it apart.
278 – 2. It must be an applied outside force.
278 – 3. Strain is the distortion or change produced in a body as the result of stress.
278 – 4. The ability of a body that has been changed, or deformed, under stress to again assume its original shape when the stress is removed.
278 – 5. The greatest stress that a structure or material can withstand without fracture or rupture.
278 – 6. Allows it to withstand permanent deformation under compressive stress without rupture.
278 – 7. In terms of its resistance to indentation.
278 – 8. It causes some materials to exhbit continuous deformity.
278 – 9. The ability of a material to conduct heat.
278 – 10. It involves the interplay of viscosity, wetting, film thickness, and surface tension.

279 – 1. Because of some faulty technique in mixing.
279 – 2. It is sometimes used as a die material; it is also used as a restorative material.
279 – 3. The fusion of two or more metals.
279 – 4. 65 percent silver, minimum weight; 29 percent tin, maximum weight; 6 percent copper, maximum weight; 2 percent zinc, maximum weight; and 3 percent mercury, maximum weight.
279 – 5. Increases the hardness and expansion while decreasing the flow and setting time.
279 – 6. Those alloys that contain a small percentage of mercury.
279 – 7. It reacts chemically with the particles of silver in the alloy to bond the particles of silver to the other particles in the alloy.
279 – 8. ANy three of the following will suffice. It is easily adapted to a prepared cavity; it also is dimensionally stable; it has adequate strength when set; it resists discoloration; and it has a suitable setting time.
279 – 9. Thermal conductivity; poor color.

280 – 1. The manufacturer's directions.
280 – 2. A mercury/alloy of 1:1.
280 – 3. To achieve maximum amalgam strength.
280 – 4. An absorption of the mercury by the alloy particles.
280 – 5. Improper trituration, manipulation, and condensation.
280 – 6. Because the restoration in a tooth is subject to compressive shearing and tensile stresses.

281 – 1. The manufacturer.
281 – 2. Replace it with a mix of proper consistency. The resulting compressive strength of the mix will be about one-tenth of its normal strength if mercury is added to a "dry mix."
281 – 3. Overtrituration decreases the setting time and increases the shrinkage; conversely, undertrituration increases the setting time, increases the expansion and weakens the amalgam.
281 – 4. Contaminating the mix with moisture or other impurities.
281 – 5. Delayed and excessive expansion, lowered crushing strength, blister formation on the amalgam surface, and pain shortly after the filling is inserted.
281 – 6. By mulling it in a moist palm, touching or handling it with moist fingers, or triturating it at a temperature below the dewpoint.
281 – 7. Place a few drops of mercury in the capsule and place it on the amalgamator for a few seconds.

282 – 1. For applications such as denture bases, for partial denture structures and occasionally for certain types of bridgework. It is also used for dental implants.
282 – 2. It is silver-white and lustrous.
282 – 3. They are lighter in weight, resist corrosion, have good mechanical properties, and are less expensive than the gold alloys.
282 – 4. The necessity of using specialized equipment and techniques.

283 – 1. It is soft, malleable, ductile, and does not oxidize.
283 – 2. Gold, silver and copper modified with platinum, palladium and zinc.
283 – 3. It is soft and subject to very slight stress, and it is used where burnishing is desired.
283 – 4. Extra hard, thin in cross section, and subject to very high stress.
283 – 5. A thin metal "thimble" is cast; the porcelain or enamel is then fused as a veneer on the crown so that little or no metal is visible; a layer of opaque porcelain is fused against the casting; the tooth contour is built up and the finished enamel-veneered crown is then cemented on the prepared tooth.

284 – 1. They are primarily used to restore anterior teeth and are particularly suitable for incisal restorations. Because of their crushing strength.
284 – 2. The composite material and catalyst.
284 – 3. The binders are modified acrylates that bind the mix during setting. The fillers are translucent mineral fibers that provide a light transmission system for adapting the color of the filling material to the surrounding tooth structure.
284 – 4. Paste.
284 – 5. It causes the composite restorative material to set or harden.
284 – 6. You should have checked a, b, f, g, h, j, and k.
284 – 7. This technique utilizes a solution of 35 to 50 percent phosphoric acid. The resin penetrates into the surface irregularities created by the etchant and forms resin tags that mechanically interlock the filaments of resin with the enamal surface.
284 – 8. Instead of the chemical reaction that causes polymerization with regular composite materials, a visible light source causes the polymerization.

285 – 1. Zinc phosphate cement is used as a cementing agent for crowns, inlays, and fixed partial dentures. It is also used as a temporary filling material and as an insulating base under amalgam restorations.
285 – 2. Zinc oxide.
285 – 3. You should have checked b, c, d, and f.
285 – 4. A clean, cool, dry glass slab and a #313 or #324 stainless steel spatula.
285 – 5. Approximately 1½ minutes.
285 – 6. From 1¾ to 2 minutes.
285 – 7. The heat created by the chemical action of the material will injure the tooth pulp if it is not dissipated.
285 – 8. You should have checked a, b, e, and g.

286 – 1. (1) c.
(2) e.
(3) b.
(4) d.
(5) f.
(6) a.

287 – 1. To protect the dental pulp from thermal, chemical, electrical, and any other possible source of irritation.
287 – 2. Because it seems to stimulate the production of secondary dentin.
287 – 3. Simply place small, equal portions of the base and catalyst on the mixing pad and mix together.
287 – 4. Sterile water or local anesthetic.
287 – 5. Place equal portions of the base material and the catalyst on the mixing pad and mix together.
287 – 6. Zinc acetate.
287 – 7. As much as possible.
287 – 8. Yes.
287 – 9. To partially insulate the tooth structures from certain chemicals and to temporarily seal the margins of restorations.
287 – 10. Add some of the thinner that is supplied with the liners and varnishes. This will return them to a usable consistency.

288 – 1. The self-curing form.
288 – 2. The powder is polymer and the liquid is monomer.
288 – 3. To fabricate acrylic resin crowns or veneer crowns.
288 – 4. To construct customized impression trays for final, detailed impressions.

289 – 1. Heat.
289 – 2. To form casts; construct matrices; attach cases to articulators; to be combined as an ingredient in certain impressions.
289 – 3. The initial setting time ranges from 5 to 12 minutes and the final set occurs within approximately 45 minutes.
289 – 4. Plaster of Paris.
289 – 5. For pouring casts and dies and flashing dentures for processing.
289 – 6. The initial set of a typical hydrocoal mix varies from 7 to 15 minutes. The final set is complete within approximately 45 minutes.

290 – 1. (1) b.
    (2) e.
    (3) d.
    (4) b.
    (5) c.
    (6) h.
    (7) f.
    (8) a.

291 – 1. They are used with copper bands for inlay and crown impressions and for recording functional or preliminary impressions.
291 – 2. Overheating makes them so sticky that they are extremely difficult to handle. When they cool, plastic impression compounds become hard and brittle.
291 – 3. They can be used as a "wash" to correct defects or deficiencies in other impressions.
291 – 4. Decrease the amount of hardener.
291 – 5. Because of their unstable polysulfide base.
291 – 6. Light bodied, to be injected with a syringe into preparations for inlays, crowns, and fixed partial dentures; regular bodied, to be used in an impression tray for inlays, crowns and fixed partial dentures and as "wash" impressions for full dentures, relinings, and removable partial dentures; heavy bodied, to be used in a tray to force light bodied impression material into the cavity preparation or with a copper band for impressions of single teeth.
291 – 7. A colloid in which the dispersing medium is water.
291 – 8. It is known as a sol when it is in a liquid solution; when it is in semisolid form similar to jelly, it is known as a gel.
291 – 9. Reversible and irreversible.
291 – 10. The odor and flavor must be pleasant; the material must not irritate oral tissues; and the temperature of the gel formation must not be less than 98.6° F and not more than 113° F.
291 – 11. Type I, fast setting; type II, normal setting.
291 – 12. Elevated temperature,s, the presence of moisture or both of the preceding conditions.
291 – 13. High temperature can speed the setting time; cold can retard the setting time.
291 – 14. Avoid syneresis, caused by leaving the impression in the air; or imbibition, caused by soaking the impression.

in water.

292 – 1. They are saturated with antiseptics and injected into the canal. They are never used as permanent root canal material.
292 – 2. It should be insoluble in tissue fluids, opaque to X-rays, reasonably easy to remove, nonirritating to periapical tissues, nonabsorbent, and dimensionally stable after insertion.
292 – 3. As a root canal restorative material.
292 – 4. It shrinks when used with a solvent and is not always easily inserted into the root canal.
292 – 5. They are difficult to remove from the canal.
292 – 6. The zinc oxide and eugenol type.
292 – 7. Gutta-percha is dissolved in chloroform or eucalyptol.

293 – 1. To act as a protective barrier and a soothing and healing agent; they treat dry sockets; and act as a gingival bandage after periodontal surgery.
293 – 2. On those whose surgery left some exposed bone or those who are allergic to eugenol.
293 – 3. (1) c.
    (2) c, b.
    (3) b, a.
    (4) e, d.

294 – 1. (1) d.
    (2) g.
    (3) a.
    (4) c.
    (5) h.
    (6) e.
    (7) b.
    (8) f.
    (9) i.

CHAPTER 5

295 – 1. Topical; oral; inhalation; injection; and rectal.
295 – 2. Applying the drug to the surface of the skin or mucous membrane to produce a local effect.
295 – 3. Because it is painless, requires no special apparatus, and produces a systemic effect in a short period of time.
295 – 4. (1) e.
    (2) c.
    (3) a.
    (4) b.
    (5) d.
    (6) f.

295 – 5. Inhalation.
295 – 6. Normal saline.
295 – 7. Because with this method a pool of medicament is deposited in the muscle and is then slowly absorbed into the tissues.
295 – 8. This delays absorption and further prolongs the drug's action.
295 – 9. Injecting into a blood vessel would result in a more rapid absorption of the medicament than desired or intended. This could be dangerous, since the rapid absorption would place too much of the drug in the patient's system at one time.
295 – 10. Intravenous.
295 – 11. a. The effect desired; b. the rapidity of the action needed; c. the nature and amount of the drug to be given; and d. the physical condition of the patient.

296 – 1. The effect that a drug or medication produces at the point or area of application or introduction.
296 – 2. The action of a drug on some tissue or organ remote from the site of introduction. Such action occurs only after the drug has been absorbed or has entered the vascular system.
296 – 3. F. Only at the point or area of application of introduction.
296 – 4. F. It should be absorbed.
296 – 5. T.
296 – 6. T.

297 – 1. (1) b.
    (2) a.
    (3) d.
    (4) c.

298 – 1. (1) e.
(2) f.
(3) b.
(4) g.
(5) a.
(6) i.
(7) h.
(8) d.
(9) j.
(10) c.

299 – 1. The manufacturer of the drugs.
299 – 2. Its generic name.
299 – 3. The *United States Pharmacopeia* and the *National Formulary*.
299 – 4. *Accepted Dental Therapeutics and Physician's Desk Reference*.
300 – 1. a. Exhibit selective and effective antimicrobial activity; b. have little or no side or untoward effect; c. not disturb any vital organ or its function; d. not have its effect reduced by the body's fluid, plasma, protein, or enzymes; e. be water soluble and stable; and f. be manufactured at a reasonable cost to the patient. 300 – 2. Organisms that are sensitive to penicillin are not only inhibited from further growth but in some cases are actually killed by adequate concentrations of the penicillins.
300 – 3. That the bacteria actively multiply.
300 – 4. Hypersensitivity.
300 – 5. It could prove fatal to a patient. Because penicillin G is insoluble and is transported to the lungs where it acts as a pulmonary obstruction.
300 – 6. Bactericidal action.
300 – 7. It adversely affects the central nervous system, particularly the eighth cranial nerve.
300 – 8. Their use is contraindicated during periods of tooth development. They may produce disfiguring stains on teeth.
300 – 9. Bacteriostatic.

301 – 1. Analgesics are drugs which relieve pain without acting to depress consciousness.
301 – 2. Narcotic analgesics.
301 – 3. Morphine.
301 – 4. It is habit forming, depresses breathing, and contracts the pupils of the eyes.
301 – 5. It is less habit forming.
301 – 6. Merperidine.
301 – 7. Non-narotic analgesics.
301 – 8. Salicylates.
301 – 9. They reduce fever.
301 – 10. Salicylism.
301 – 11. Those with ulcer.
301 – 12. In the treatment of musculoskeletal conditions and when the patient is allergic to aspirin.

302 – 1. To relax the patient or to induce sleep.
302 – 2. By the duration of their clinical effects into "ultrashort," "short," "intermediate," and "long" acting compounds.
302 – 3. Shock and severe respiratory depression, especially if the injection is too rapid.
302 – 4. Promethazine hydrochloride (Phenergan).

303 – 1. To stop the hemorrhage of blood.
303 – 2. Gelatin sponge, oxidized cellulose, and oxidized regenerated cellulose.
303 – 3. Their method of manufacture.
303 – 4. To pack sockets and as a sutured implant in soft tissues.
303 – 5. When there is a history of blood coagulation problems.

304 – 1. T.
304 – 2. T.
304 – 3. T.
304 – 4. T.
304 – 5. F. Regional-infiltration anesthesia.
304 – 6. F. Anesthetics are administered to eliminate sensation to pain that might be produced by the operative or surgical treatment of a condition.
304 – 7. F. Topical anesthetics are usually applied with a cotton-tipped applicator or aerosol spray.

305 – 1. To constrict blood vessels.
305 – 2. Epinephrine.
305 – 3. Prolongs its effects.
305 – 4. Antisialagogues.
305 – 5. They cause dryness of the throat and speech difficulty.
305 – 6. Atropine sulfate and scopolamine.

306 – 1. Allergic.
306 – 2. Benadryl.
306 – 3. Drowiness, dizziness, and disturbances of body coordination.

307 – 1. Through the water supply.
307 – 2. Fluorosis. The average daily water intake in warm climates is greater.
307 – 4. 0.6 to 1.7 ppm.
307 – 5. Giving dietary supplements of fluoride tablets.
307 – 6. AFR 161–44, *Management of the Drinking Water Surveillance Program*.

308 – 1. Cleansing purposes; to aid in rendering treatment.
308 – 2. Orange oil, ethyl alcohol, and isopropyl alcohol.
308 – 3. Chloroform and eucalyptol.

309 – 1. Creosote is used as a desensitizing paste when mixed with camphor and as a pulp-capping material when mixed with zinc oxide Camphorated parachlorophenal is used to sterilize root canals.
309 – 2. A 50-percent solution of alcohol.

310 – 1. T.
310 – 2. T.
310 – 3. F. The abrasiveness of some available dentifrices is so high that they can scratch tooth enamel and severely erode the dentin.
310 – 4. F. It is sometimes recommended because of its cleansing ability and relatively low abrasiveness.
310 – 5. F. These claims have been largely refuted.
310 – 6. T.

311 – 1. Bristle—soft to medium; flat brushing surface formed by multiple tufts; head size—small to medium.
311 – 2. Type of treatment, dental condition, size of mouth, patient's manipulative ability.
311 – 3. Snapping the floss can injure the gingival tissues.
311 – 4. The patient will need a regular mirror and a mouth mirror to ensure that the inside surfaces are clean.
311 – 5. Irrigators.
311 – 6. No. Brushing the teeth usually gives the necessary massaging.

STOP-
1. **MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.**
2. **USE NUMBER 2 PENCIL ONLY.**

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

98150 02 25

BASIC SCIENCES

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (200) The wall or external cell membrane of the cell functions to

   a. govern which nutrients and materials will be taken into the cell.
   b. regulate or govern the cell's activity.
   c. transfer food away from the cell.
   d. complete mitosis and create cytoplasm.

2. (200) Which of the following is *not* an active phase of mitosis?

   a. Prophase.
   b. Metaphase.
   c. Telophase.
   d. Interphase.

3. (201) The tissue that covers the surface of the body and lines the passageways and cavities is termed

   a. epithelial.
   b. connective.
   c. muscle.
   d. nerve.

4. (202) A substance composed of iron, salt, and a protein that gives blood cells their characteristic red color is called

   a. erythrocyte.
   b. platelets.
   c. thrombin.
   d. hemoglobin.

5. (202) The chemicals necessary for blood clotting is in the cytoplasm of

   a. red blood cells.
   b. white blood cells.
   c. platelets.
   d. plasma.

6. (203) The body system that transports oxygen and nutrition in the blood to all parts of the body is the

   a. integumentary system.
   b. respiratory system.
   c. circulatory system.
   d. excretory system.

7. (204) Skin is made up of how many principal layers?

   a. One.
   b. Two.
   c. Three.
   d. Four.

8. (205) Vertebrae, mandible, and pelvis are classified as what type of bones?

   a. Long.
   b. Flat.
   c. Short.
   d. Irregular.

9. (205) The thin membrane that covers the surface of bones and contains the nerves and blood vessels is called

   a. the periosteum.
   b. the medullary.
   c. the marrow.
   d. the cancellous.

10. (206) Limb movement, locomotion, and erect posture are provided by what body system?

    a. Integumentary.
    b. Skeletal.
    c. Muscular.
    d. Nervous.

11. (207) An example of a voluntary muscle would be a muscle that is located in the

a. pharynx.
b. respiratory passages.
c. urinary bladder.
d. walls of the blood vessels.

12. (208) Which muscle, located on the side of the neck, serves as a liner, acts to pull the head left or right on the shoulders, and flexes the head toward the chest or shoulders?

a. Deltoid.
b. Trapezius.
c. Temporalis.
d. Sternocleidomastoid.

13. (209) Which of the following is *not* a function of the circulatory system?

a. Distributes the hormones of the endocrine glands to the cells which they regulate.
b. Assists respiration and excretory functions by carrying oxygen from the lungs to the cells and carbon dioxide from the cells to the lungs.
c. Transports waste products from the organs of excretion.
d. Carries amino acids, lipids, inorganic salts, and vitamins from the digestive tract to the cells.

14. (210) The membranous sac that encloses the heart is the

a. endocardium.
b. myocardium.
c. epicardium.
d. pericardium.

15. (211) Which related organ of the lymphatic system is located in the posterior of the mouth between the anterior and posterior pillars of the fauces?

a. Thymus.
b. Spleen.
c. Palatine tonsils.
d. Nasopharyngeal tonsil.

16. (212) What part of the lower respiratory system was a cylindrical tube composed of 16 to 29 c-shaped cartilage rings and is lined with cilia and mucous glands which help entrap dust and foreign matter?

a. Trachea.
b. Pharynx.
c. Larynx.
d. Bronchi.

17. (213) The process of breathing is a harmonious interplay of nerve impulses, muscular activity, and mechanical pressure changes which are all influenced by chemical changes in the

a. blood.
b. brain.
c. lungs.
d. air.

18. (214) What part of the alimentary canal extends from the end of the pharynx to the stomach?

a. Epiglottis.
b. Trachea.
c. Esophagus.
d. Larynx.

19. (215) The reservoir for concentrating and storing bile is the

a. pancreas.
b. liver.
c. gallbladder.
d. ampulla of vater.

20. (216) What types of neurons carry impulses from the periphery of the nervous system toward the spine and brain?

a. Ganglionic.
b. Effective or motor.
c. Afferent.
d. Efferent.

21. (217) The largest part of the brain which contains the frontal, parietal, occipital and temporal lobes is the

a. cerebellum.
b. medulla oblongata.
c. pons.
d. cerebrum.

22. (218) The peripheral nervous system, made up of both cranial and spinal nerves, has a total number of

a. 12 nerves.
b. 21 nerves.
c. 31 nerves.
d. 43 nerves.

23. (219) The part of the urinary system that was a tube passing from the bladder to the exterior of the body is

a. the urinary bladder.
b. the urine.
c. the urethra.
d. the ureters.

24. (220) An oily substance that is primarily responsible for the lubrication of the surface of the skin is

a. sebum.
b. sweat.
c. exocrine.
d. salts.

25. (221) The pea-sized gland located at the base of the brain that has control over all other endocrine glands in the body is the

a. thyroid.
b. pituitary.
c. adrenal.
d. gonad.

26. (222) Which structures suspend and supply the testes in the scrotum?

a. Cowper's glands.
b. Ejaculatory ducts.
c. Spermatic cords.
d. Seminal vesicles.

27. (223) Which part of the female reproductive structure is a muscular canal that extends from the cervix to the vulva?

a. The vagina.
b. The uterus.
c. The ovaries.
d. The mammary glands.

28. (224) Once the ova (egg) becomes fertilized it is implanted in the

a. ovaries.
b. endometrium.
c. fallopian tubes.
d. vagina.

29. (225) Mass endows each body of matter with a gravitational attraction and thereby gives it

a. energy.
b. length.
c. an electrical charge.
d. weight.

30. (226) In what state of matter are particles closely packed together and remain in a fixed position?

a. Gas.
b. Liquid.
c. Solid.
d. Electrical.

31. (227) Which of the following is a physical characteristic of a substance?

a. Reaction with heat.
b. Energy content.
c. Reaction with light.
d. Odor.

32. (227) Which of the following is a chemical characteristic of a substance?

a. Solubility.
b. Energy content.
c. Freezing point.
d. Color.

33. (228) What name is given to the smallest basic particles of an element that still maintains all the characteristics of that element?

a. Atoms.
b. Protons.
c. Molecules.
d. Electrons.

34. (229) When two atoms of hydrogen unite with one atom of oxygen what will result?

a. Hydrogen peroxide.
b. Saline.
c. Steam.
d. Water.

35. (230) The simplest method by which compounds are formed is

a. decomposition.
b. combination.
c. single replacement.
d. double replacement.

36. (231) What has been classically defined as substances that contain hydrogen which donate hydrogen ions in a solution?

a. Acids.
b. Base.
c. Salts.
d. Hydroxyls.

37. (232) In order to achieve the proper pH of a substance and maintain it, we use compounds that are called

a. alkalines.
b. neutral salts.
c. buffers.
d. acids.

38. (233) When sugar or salt is dissolved in water or a similar substance the resultant mixture is called

a. a single replacement.
b. a double replacement.
c. a suspension.
d. a solution.

39. (234) When using the metric system, the number you multiply or divide to reach the desired higher or lower unit is

a. 10.
b. 20.
c. 50.
d. 100.

40. (235) A bacteria cell differs from a typical cell in that it does *not* have

a. a nucleus.
b. a membrane.
c. an organized membrane.
d. an organized nucleus.

41. (236) Which category of bacteria is an organism that so severely damages its host that the host will either die or be permanently damaged?

a. Pathogen.
b. Parasite.
c. Saprophyte.
d. Virulent pathogen.

42. (237) Who decides which methods of sterilization and disinfection are to be used in a dental clinic?

a. The NCOIC of the dental clinic.
b. The dental superintendent.
c. The base dental surgeon.
d. The hospital commander.

43. (238) The term that means the presence of disease-producing micro-organisms is

a. asepsis.
b. sepsis.
c. contamination.
d. decontamination.

44. (239) An agent which inhibits microbial reproduction but does *not* kill the population is known as

a. a bacteriastatic.
b. a disinfectant.
c. a bactericide.
d. a germicide.

45. (240) What percent of concentrations of ethyl or isopropyl alcohol are effective against vegetative bacteria of all kinds?

a. 25 to 45 percent.
b. 50 to 55 percent.
c. 60 to 95 percent.
d. 70 to 100 percent.

46. (241) Which bone is in the back and at the base of the skull?

a. Sphenoid.
b. Occipital.
c. Ethmoid.
d. Parietal.

47. (242) Which two bones form a large portion of the sockets of the eyes and the prominence of the checks?

a. Vomer.
b. Palatine.
c. Zygoma.
d. Lacrimal.

48. (243) What are the four primary muscles of mastication?

a. Temporalis, lateral pterygoid, medial pterygoid, and mylohyoid.
b. Masseter, temporalis, lateral pterygoid, and buccinator.
c. Masseter, temporalis, medial pterygoid, and lateral pterygoid.
d. Masseter, buccinator, mylohyoid, and medial pterygoid.

49. (244) The facial muscles of expression are innervated by which nerve?

a. The seventh cranial nerve.
b. The ophthalmic nerve.
c. The maxillary nerve.
d. The fifth cranial nerve.

50. (245) Which branch of the trigeminal nerve innervates the third molar, the second molar, and the lingual and distofacial root of the first molar?

a. Facial.
b. Ophthalmic.
c. Maxillary.
d. Mandibular.

51. (246) Which of the following arteries supplies blood to the head and neck?

a. The common carotid.
b. The internal carotid.
c. The pulmonary.
d. The internal pulmonary.

52. (247) Lymph fluid is derived from

a. blood plasma.
b. the bone marrow.
c. the liver.
d. the spleen.

53. (248) Which mucosa has an abundant supply of elastic fibers that allows free movement and elasticity?

a. Masticatory.
b. Specialized.
c. Lining.
d. Connective.

54. (249) What sickle-shaped extensions of connective tissue connect the lips to the alveolar ridges?

a. The maxillary foramen.
b. The labial frema.
c. The ligual frema.
d. The mandibular foramen.

55. (249) Parotid glands empty their secretions into the oral cavity through what ducts?

a. Stensen's.
b. Submaxillary.
c. Whorton's.
d. Sublingual.

56. (250) What cells form enamel, degenerate, and then disappear?

a. Odontoblasts.
b. Ameloblasts.
c. Odontoclasts.
d. Ameloclasts.

57. (250) What is the primary function of dental pulp?

a. To provide nourishment to the dentin.
b. To respond to sensations and irritations exerted upon the whole tooth.
c. To serve as an attachment for the periodontal fibers.
d. To form dentin.

58. (251) Which group of periodontal fibers extends from the cementum of one tooth over the alveolar crest to the cementum of the adjacent tooth?

a. Horizonal.
b. Transseptal.
c. Interradicular.
d. Apical.

59. (252) During what period of intrauterine life does dental development begin?

a. 5th to 6th week.
b. 8th to 12th week.
c. 14th to 20th week.
d. 24th to 32nd week.

60. (253) The surfaces of each tooth are named according to what?

a. The kind of tooth it is.
b. The direction they face.
c. If it is a maxillary or mandibular tooth.
d. It it is a anterior or posterior tooth.

61. (254) What are succedaneous teeth?

a. Permanent.
b. Primary.
c. Molars.
d. Incisors.

62. (255) Mamelons are found on which teeth?

a. Newly erupted third molars.
b. Mandibular cuspids.
c. Maxillary first molars.
d. Newly erupted incisors.

63. (256) Of what is plaque mostly composed?

a. Of water and approximately 20 percent bacteria.
b. Of mucin and approximately 80 percent bacteria.
c. Of epithelial cells, water and 20 percent bacteria.
d. Of water, mucin, and epithelial cells.

64. (257) On what is the physiochemical theory of calcification based?

a. The precipitation of minerals into the organic matrix provided by bacteria.
b. Enyzmes, produced by bacteria which may cause precipitation of minerals in the saliva.
c. The percipitation of minerals in the saliva.
d. The percipitation of enzymes in the saliva.

65. (258) What condition occurs when defects in the enamel surface trap stains?

a. Exogenous staining.
b. Intrinsic staining.
c. Extrinsic staining.
d. Chromogenic staining.

66. (259) Which of the four signs of inflammation is calor?

a. Pain.
b. Heat.
c. Redness.
d. Swelling.

67. (260) The sign of heat is a result of which type of response?

a. Nerve.
b. Cellular.
c. Vascular.
d. Humoral.

68. (261) Which of the following bacteria does *not* produce lactic acid as a result of ingesting carbohydrates and refined sugar?

a. Lactobacillus.
b. Acidophilus.
c. Streptococci.
d. Staphylococci.

69. (262) What is usually the cause of secondary pulpitis?

a. Caries.
b. Traumatic causes.
c. Abscess.
d. Systemic causes.

70. (263) What is the most common condition following untreated, acute pulpitis?

a. Cellulitis.
b. Periocornites.
c. Parietal abscess.
d. Periapical abscess.

71. (264) Which of the following would be defined as an inflammation around the crown of the tooth?

a. Cellulitis.
b. Parietal abscess.
c. Periocornitis.
d. Periopical abscess.

72. (265) What condition may develop as the result of a chronic periapical abscess that causes epithelial rest cells to proliferate and successfully surround the chronic abscess?

a. Granuloma.
b. Perioconites.
c. Developmental cysts.
d. Inflammatory cysts.

73. (266) Which of the following is a inflammatory periodontal disease?

a. Gingivosis.
b. Periodontosis.
c. Periodontitis.
d. Occlusal traumatism.

74. (267) Which of the following forms of gingivites results in the formation of gingival pockets as a result of an increase in the bulk of the gingiva without the destruction of the underlying alveolar bone and periodontal ligaments?

a. Marginal.
b. Hormonal.
c. Desquamative.
d. Acute necrotizing.

75. (268) Which of the following diseases is an inflammation of the periodontium, including both the gingiva and tooth attachment apparatus?

a. Periodontosis.
b. Periodontitis.
c. Gingivosis.
d. Gingivitis.

76. (269) Which of the following conditions is an uncommon occurrence of a nonspecific, noninflammatory, degeneration of the periodontium?

a. Gingivitis.	c. Periodontosis.
b. Gingivitosis.	d. Periodontitis.

77. (270) Which condition is responsible for approximately 13 percent of the white lesions of the mouth?

a. Mucocoele.	c. Lechen planus.
b. Fordyse granules.	d. Leukoplakia.

78. (271) The first stage of what disease is characterized by the appearance of a lesion called chancre?

a. Measles.	c. Tuberculosis.
b. Syphilis.	d. Hemangioma.

79. (272) A hard tumor of bonelike structure developing on a bone is called a

a. carcinoma.	c. alveolar osteitis.
b. osteoma.	d. adenocarcinoma.

80. (273) An extremely painful condition that results when a normal blood clot fails to form or becomes dislodged is

a. a developmental cyst.	c. an osteoma.
b. an alveolar osteitis.	d. a granuloma.

81. (274) What is the most common reason for the hospitalization of dental patients?

a. Fractures.	c. Infective gingivitis.
b. Extractions.	d. Osteocarcinomas.

82. (275) Which of the following will *not* cause a chemical burn?

a. Eugenol.	c. Aspirin.
b. Impression waxes.	d. Phenolic compounds.

83. (276) Angular cheilosis is the result of what vitamin deficiency?

a. Vitamin B.	c. Vitamin D.
b. Vitamin C.	d. Vitamin K.

84. (277) The small electrical currents created whenever two metals are present in an oral cavity are called

a. temperature effects.	c. microleakages.
b. galvanism.	d. biological limitations.

85. (278) The internal reaction or resistance within a body to any externally applied force is called

a. elasticity.	c. stress.
b. strain.	d. ultimate strength.

86. (279) What material in a dental alloy tends to increase in strength, durability, and expansion as it decreases the flow and setting time?

a. Tin.	c. Silver.
b. Zinc.	d. Copper.

87. (280) Whose directions should be consulted in regard to the correct ratio to be used with any particular brand of alloy?

a. The medical supply section.
b. The manufacturer.
c. The dentist.
d. The assistant.

88. (281) Who assures high-quality amalgam restorations?

a. The manufacturer.
b. The dental assistant.
c. The dentist.
d. All of the above.

89. (282) Chromium-containing alloys are used in dentistry as

a. partial denture frameworks.
b. posterior restorations.
c. full crowns.
d. root canal sealers.

90. (283) Prosthetic devices subject to moderate stress are made from what type of gold?

a. Type I.
b. Type II.
c. Foil.
d. Wrought.

91. (284) Composit restorative materials are used primarily for

a. facings of crowns.
b. root canal sealers.
c. posterior restorations.
d. anterior restorations.

92. (285) Which of the following is a desirable property of zinc phosphate cement?

a. Solubility.
b. Low thermal conductivity.
c. Crushing strength.
d. Shrinkage.

93. (286) Which type of cement is probably the most effective for temporarily filling teeth before a permanent restoration is placed in the mouth?

a. Resin.
b. Polycarboxylate.
c. Zinc silicophosphate.
d. Zinc oxide-eugenol.

94. (287) Calcium hydroxide powder, widely used as a pulp-capping material, has the capacity to

a. stimulate the production of secondary dentin.
b. provide a translucense to anterior restorations.
c. seal the margins of the restoration.
d. achieve a cementing level between the restoration and the tooth.

95. (289) A characteristic of all gypsum products is that it solidifies the plaster and gives off an appreciable amount of

a. heat.
b. water.
c. weight.
d. gas.

96. (288) Which form of acrylic resins is most often used in making denture repairs?

a. Veneer.
b. Fibered clear.
c. Self-cured.
d. Heat-cured.

97. (290) Which of the following is the most carefully compounded of all waxes and is used for crowns, inlays, and pontics?

a. A crown wax.
b. A utility wax.
c. An inlay wax.
d. A pontics wax.

98. (291) What impression compounds soften when heated and harden when cooled with no chemical reaction taking place?

a. Plastic.
b. An impression paste.
c. Rubber-base.
d. hydrocolloid.

99. (292) Paper points are primarily used to

a. seal root canals.
b. widen root canals.
c. dry out canals.
d. deposit antiseptics in a canal.

100. (293) Surgical packs are placed

a. into caries lesions to ease pain.
b. in sockets after a tooth has been extracted.
c. in a root canal after an endodontic treatment.
d. on soft tissue or bony wounds as a protective barrier.

101. (294) What material is used to impart a high luster to gold?

a. An abrasive paste.
b. Tripole.
c. Zirconium silicate.
d. Rouge.

102. (295) The onset action of intramuscular drugs will likely be

a. slow and its duration will be prolonged.
b. slow and its duration will be relatively short.
c. fast and its duration will be prolonged.
d. fast and its duration will be relatively short.

103. (296) Which of the following drug requirements necessitates the need for a local drug rather than a systemic drug?

a. When it must be able to permeate cell membranes.
b. When it must reach specific, remote cells to modify an existing function.
c. When it must be excreted or destroyed within the body.
d. When it must produce an effect upon tissue at the point of application.

104. (297) The use of an estrogen for a nonavailable normal hormone is what type of a systemic drug action?

a. Replacement.
b. Stimulation.
c. Depression.
d. Irritation.

105. (298) When the side effect of a drug is or can be harmful, the side effect is known as

a. an antagonistic effect.
b. an untoward effect.
c. A cumulative effect.
d. a synergistic effect.

106. (299) The trade or proprietary name for a drug is established by the

a. pharmacist.
b. manufacturer.
c. National Formulary (N.F.).
d. United States Pharmacopeia (U.S.P.).

107. (300) Which statement is an exception to the characteristics of an ideal antibiotic?

a. It must have little or no side or untoward effect.
b. It must not disturb any vital organ or its function.
c. It must be soluble in a variety of solvents, stable, and available at a reasonable cost.
d. Its effectiveness must be reduced by body fluid, plasma, protein, or enzymes.

108. (301) A narcotic analgesic that is ideally suited for cough suppression with as little side effects as possible would be

a. codeine.
b. meperidine.
c. a morphine sulfate.
d. acetaminophen.

109. (302) Which of the following barbiturates would be used as a mild sedative for short-action purposes?

a. Diazepam (Valum).
b. Aprobarbital.
c. Pentobarbital sodium (Nembutal).
d. Amobarbital.

110. (303) Which of the following vitamins is most closely associated with the coagulation process?

a. A.
b. C.
c. D.
d. K.

111. (304) Anesthetics, as compared to analgesics, are administered to diminish or eliminate the sensation to pain

a. from an existing condition.
b. that might be produced by surgical treatments.
c. arising from deep-seated conditions.
d. by blocking nerve impulses.

112. (305) Why would an antisialogogue be administered to a dental patient?

a. To prevent bleeding.
b. To reduce the flow of saliva.
c. To disinfect the tissue at the operative site.
d. To combat an allergic reaction to the anesthetic solution.

113. (306) In dentistry antihistamines are used to

a. prolong the effect of anesthesia.
b. reduce the flow of blood.
c. reduce the flow of saliva.
d. counteract the body's allergic reaction to a drug.

114. (307) Ideally, the dosage (P.P.M.) of fluoride to drinking water should average

a. 0.6 part fluoride to a million parts water.
b. 1.0 part fluoride to a million parts water.
c. 5.7 parts fluoride to a million parts water.
d. 10.0 parts fluoride to a million parts water.

115. (308) What solvent is effective for partially dissolving and softening gutta-percha points before they are inserted as root canal-filling materials?

a. Isopropyl alcohol.
b. Ethyl alcohol.
c. Orange oil.
d. Chloroform.

116. (309) What solution should be available for use as a neutralizer whenever you are using phenol?

a. Water.
b. A 50 percent solution of alcohol.
c. A 3 percent solution of hydrogen peroxide.
d. Orange oil.

117. (310) What dentifrice is recommended to all patients?

a. Any that contains fluoride.
b. A desensitizing dentifrice.
c. A dentifrice with low abrasiveness.
d. The recommendations will be based on individual cases.

118. (311) Disclosing agents are dyes that are used to stain

a. contrasting areas.
b. infected gingiva.
c. bacterial plaques.
d. incipient caries.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012 and EO 9397. **PRINCIPAL PURPOSES:** To provide student assistance as requested by individual students. **ROUTINE USES:** This form is shipped with ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. **DISCLOSURE:** Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance to the student.

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1. THIS REQUEST CONCERNS COURSE (1 - 6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER

5. SOCIAL SECURITY NUMBER (7 - 15) ☐☐☐ - ☐☐ - ☐☐☐☐	6. GRADE/RANK	7. NAME *(First initial, second initial, last name)* (17) (18) (19-32)

8. ADDRESS *(OJT Enrollees -- Address of unit training office with zip code. All others -- current mailing address with zip code.)*	(33-53) (54-75)

9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE	10. TEST CONTROL OFFICE ZIP CODE/SHRED (33 - 39)

SECTION II: REQUEST FOR MATERIALS, RECORDS, OR SERVICE

(Place an 'X' through number in box to left of service requested)

1	Request address change as indicated in Section I.
2	Request Test Control Office change as indicated in Section I.
3	Request name change/correction (Provide Old or Incorrect data)
4	Request Grade/Rank change/correction.
5	Correct SSAN. (List incorrect SSAN here) (Correct SSAN should be shown in Section I)
6	Extend course completion date. (Justify in REMARKS)
7	Request enrollment cancellation.
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. (Specify in REMARKS) ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on ______________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 not yet received. Answer sheet(s) submitted ______________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on ______________ (date).
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14	Give instructional assistance as requested on reverse.
15	Other (Explain fully in REMARKS)

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38 1	39 - 42	
2	39 - 42	
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16		

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NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

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DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

Volume 3

Administrative Functions and Chairside Assisting

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Preface

THIS THIRD volume of your Career Development Course (CDC) discusses the various procedures and forms you will use in performing your assisting duties. It also covers the different instruments, housekeeping, and maintenance procedures, and general and specialty assisting techniques used in modern dentistry. Each chapter covers a particular segment of the many instruments and procedures required for you to become the best possible dental assistant.

Chapter 1 covers all aspects of the administrative functions you will be expected to know and perform. Chapter 2 gives you guidance and information that will enable you to function with and in the dental supply section. It also tells how to find and use the publications and the forms you will need in doing your job. Chapter 3 deals with the dental instruments you will use. The information it presents ranges from the classification of instruments through instrument sharpening. Chapter 4 covers the housekeeping and equipment maintenance you will be expected to perform and those duties that are not your responsibility to perform, but to bring to the attention of those individuals who will make the necessary repairs, etc. Last, Chapters 5 and 6 are devoted to all aspects of your primary job, assisting. Your duties as an assistant, whether you are working in examinations or as one of the specialties, are critical to almost every dental procedure. In short, your job is very important and demanding.

Foldouts 1 through 19 are bound separately as a supplement. Foldouts 1 through 6 are referenced in Volume 2, and foldouts 7 through 19 are referenced in Volume 3. Refer to them as the text directs.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

This volume is valued at 51 hours (17 points).

Material in this volume is technically accurate, adequate and current as of April 1984.

Contents

Page

Preface iii

Chapter

1 Dental Administration 1

2 Publications and Dental Supply 35

3 Dental Instruments 43

4 Housekeeping and Equipment Maintenance 68

5 Professional Standards and General Assisting Procedures 83

6 Specialty Assisting Procedures 100

Bibliography 128

Answers for Exercises 129

CHAPTER 1

Dental Administration

THE DENTAL SERVICE, like other services in the Armed Forces, keeps records that are primarily for its own use. There are several reasons for keeping dental records. The most important reason is to improve patient morale through an efficient system of appointments. Records also help us assess the quantity of our treatment, provides information for budget preparation and legal matters, and supplies the necessary information for reports that higher headquarters use to plan and to act. For these reasons, you should take great care to keep accurate and factual records.

The scheduling of patients for dental treatment includes receiving and directing patients and answering inquiries about clinical policies and procedures. You must not only be knowledgeable about administration, but you must also be able to communicate with dental patients. This requires a basic understanding of patient psychology.

The material presented in this chapter will be valuable to you. This chapter covers the proper reception of patients, dental treatment records, dental reporting system, and miscellaneous forms and reports.

1-1. The Reception/Records Section

The reception/records section is the first point of contact between patients and dental personnel. The basic functions of this section are to receive patients, decide their treatment eligibility, schedule dental appointments, and prepare and keep dental patient records.

400. Identify principles of patient psychology and specify correct procedures for receiving dental patients.

Receiving Patients. The manner in which you receive a dental patient may have a more profound impact upon him or her than the actual treatment. Whatever the quality of the professional care, the patient may be resentful and dissatisfied if clinic personnel are inattentive, indifferent, or abrupt. So, you should make favorable patient reaction a primary objective. A pleasant disposition coupled with tact, and a calm courteous, and efficient manner are essential if the patient is to feel at ease. Although the actual procedures used to process patients through dental facilities may vary with local requirements, the principles of patients psychology remain the same.

Human relations. Human relations are how you relate to others. In many areas of endeavor, human relations are mainly restricted to "getting along" with coworkers. You are involved with treating people, and treating people consists of much more than curing their physical ailments. The good dental assistant is always aware that patients are human beings, and that as such, they have both physical and psychological needs.

The major physical needs of a person are food, water, shelter, rest, exercise, sex, and physical well-being. Since the Air Force satisfies most of its members physical needs, we will concentrate on how you can deal with the psychological needs of the dental patient. The psychological needs—sometimes referred to as social or personality needs—include security, recognition, affection, and achievement.

a. Security. People want regularity and stability in their lives. Too much uncertainty as to how they stand can be very unsettling. If an appointment must be delayed past its scheduled time, let the patient know. Failure to do so may cause them undue anxiety. The patient may wonder if your appointment schedule is in error, or if someone failed to tell the dentist of the appointment. These and perhaps other questions may enter the patient's mind. Keeping the patient informed helps satisfy the patient's desire for security.

b. Recognition. Every individual wants recognition and attention. We all want to be looked upon favorably by others—to feel important. We crave the esteem of the people with whom we come in contact. Your patient does not want to be just another patient; he or she desires your recognition. How can we satisfy this psychological need? Well, a good start is to address your patient by his or her name and rank. Generally, just calling someone by a last name has a tendency to "turn the person off." It makes a patient feel that he or she is just another "face in the crowd" and fails to provide the recognition needed.

c. Affection. Everyone wants warm, reciprocal relationships. If you want to be a good dental assistant, work at developing a genuine interest in your patients—and show it.

d. Achievement. Everyone wants to do something worthwhile. This desire is closely related to the need for recognition. Normal individuals are happiest when they are contributing. By informing your patient of progress toward improved oral health, you help satisfy a psychological need for achievement. This assurance normally results in the patient displaying an even greater interest and progress than before.

The code of ethics of the American Dental Assistants' Association is based on the principle of the Golden Rule, "Do unto others as you would have them do unto you." Place yourself in the patient's position. Imagine the person's possible anxiety and fear toward dental treatment. Have empathy for the person. Seldom does an individual have too much security, recognition, achievement, or affection.

Reception. The reception area of the dental service provides patients with a first impression of the type of treatment they will receive. This first impression is an important one. The finest professional care in the world usually will not erase the false impressions of your service that a lackadaisical (unconcerned) receptionist may have created. The dental receptionist should be a calm, well-groomed, articulate individual who strives to present a good first impression of the dental service to each patient.

The very heart of the term "dental service team" is the word "service." When performing your services as a dental receptionist, keep in mind that the patient is unaware of the procedures required for treatment. You must listen to each patient's problems and decide how and where to route the individual for professional care. You should explain this routing so that the patient knows what to expect. Listening to the patient as well as explaining the procedures will eliminate many future misunderstandings and problems.

When misunderstandings do occur, you must take positive action to resolve them with as little disruption as possible. Use tact and diplomacy when dealing with an upset patient. Normally, this type of patient is acting under abnormal stress; and it is difficult to reason with such a person. In handling the upset patient, guard against losing your temper. If you find that you cannot satisfy the patient, excuse yourself and have a senior NCO or an officer speak with the individual. Usually, the patient will be more receptive to someone in a position of greater authority. Above all, do not get involved in an argument with the patient.

Exercises (400):

1. List three actions you should avoid in receiving a patient to insure that the individual does not become resentful or dissatisfied.

2. What qualities should you portray in the reception of patients to make them feel at ease?

3. List the four psychological needs of humans that you should remember when receiving dental patients?

4. Match the desirable actions in column A with the psychological need in column B that they *best* fulfill. Use each applicable action only once.

Column A

_____(1) Keep a patient informed in case the appointment is delayed beyond its scheduled time.

_____(2) Inform the patient of progress toward improved oral health.

_____(3) Show a sincere interest in the patient from the outset.

_____(4) Address the patient by name and rank to make the person feel important.

Column B

a. Achievement.
b. Affection.
c. Recognition.
d. Security.

5. Indicate whether you consider each statement below as psychologically true (T) or false (F). Explain any false statements.

_____a. Having empathy for your patients helps achieve the Golden Rule of the American Dental Assistants' Association.

_____b. The ideal receptionist is concerned with a good first impression to the extent that a formal and military atmosphere is established.

_____c. Part of the service that you can render as a receptionist is to listen to each patient's problems, decide how and where to route the patient, and make any necessary explanations.

_____d. It is well to be firm with an upset patient, even to the point of showing your temper; argue your point effectively if you are right and, above all, cause the patient to be submissive.

401. From a series of statements about the general techniques of telephone communication, respond correctly to situations in which you may be involved.

Telephone Manners. Other than face-to-face conversation, the telephone is the most frequent means of personal communication. It is one of the most important pieces of equipment in the clinic. All of the elements of desired human relations already covered apply also to telephone conversations; however, since the person to whom you speak on the telephone cannot see you, this can lead to certain difficulties. Here are some general principles to remember which will be helpful in overcoming or preventing these difficulties:

a. When you speak on the telephone, you are the dental clinic. The opinion the patient has of the entire hospital may often depend on this first telephone contact. Use the telephone as a representative of Dental Service and eager to serve.

b. Use a sincere, pleasant, easy-to-understand voice. Since the person on the other end cannot see you smile, you must put the smile in your voice. Develop this habit to the point that you do it unconsciously.

c. Answer promptly. A good rule is to try to answer by the third ring.

d. Be clear, concise, and accurate. Doublecheck all specific information given or taken on the telephone. If you make the call, plan what you will say ahead of time. The other person's time is also valuable.

e. State your name, rank, and duty section, such as: "Good morning, Dental Clinic, Sergeant Eling speaking. May I help you?"

f. Know the local ground rules. Most clinics have specific ways of answering the telephone. They also have certain limitations as to the information that can be given over the telephone. Be sure you know the rules and have all the necessary information at your fingertips, especially information about appointments.

g. Never diagnose on the telephone. Diagnosis is not your function. The patient, however, does not know your qualifications; if the information required by the caller is out of your area of responsibility, call the proper authority or set up an appropriate appointment in accordance with the local rules.

h. Never prescribe on the telephone. Obtain accurate information if the dentist is busy, and decide whether the nature of the call is administrative or professional.

i. Record calls. If the telephone message is for someone who is not available at the time, or if it requires information that needs further investigation, be certain that the information is accurately and completely recorded. A convenient form (SF 63, Memorandum of Call) is available for this purpose. These forms come in pads, and if you need to keep a record of calls, slip in a piece of carbon paper.

Exercises (401):

Indicate which of the following statements are true and which are false by inserting a T or an F in the blanks provided. Explain any false statements.

_____ 1. There are no special problems connected with telephone mannerisms, since the person to whom you are speaking cannot see you.

_____ 2. When you speak on the telephone, you should speak as a representative of Dental Service and is eager for the opportunity to help.

_____ 3. It is important that your telephone voice be businesslike—never give a hint of a smile by the tone of your voice.

_____ 4. Concentrate on the task you are doing; if the phone rings, the caller can call back after you finish.

_____ 5. A caller's time is too valuable for you to ever doublecheck specific information given or taken on the telephone.

_____ 6. There are local ground rules and limitations as to information you should give on the telephone.

_____ 7. It is your function to diagnose; therefore, there are times when it is both diplomatic and proper for you to diagnose over the telephone.

_____ 8. You should diagnose and prescribe on the telephone as necessary.

_____ 9. In some cases, you should keep a record as well as a duplicate record of certain telephone messages.

402. Identify dental treatment eligibility criteria.

Determining Treatment Eligibility. Who is authorized dental care? If a person in civilian clothes came to your clinic requesting treatment, what would you do? How would you decide his or her eligibility for treatment? The easiest way is to look at the person's identification card. This will tell you whether the person is active duty, a reservist, a retiree, or a civilian. All of these categories of patients are authorized some type of treatment. To decide a patient's treatment eligibility, you must know the types of dental attendance available and the categories of patients that are authorized treatment.

Types of dental attendance. There are two types of dental attendance—general and emergency. The types of attendance indicate the scope of treatment provided.

a. General dental attendance. This includes all the medical, surgical, and restorative treatment of oral diseases, injuries, and deficiencies that come within the field of dental and oral surgery as commonly practiced by the dental profession. This service is preventive and corrective. It includes:

(1) Dental examinations and advice on dental health.
(2) Restoration of lost tooth structure.
(3) Treatment of periodontal conditions.
(4) Surgical procedures.
(5) Replacement of missing teeth essential to personal appearance, the performance of military duty, or the proper mastication of food.

b. Emergency dental attendance. This is the dental care given for humane reasons to relieve pain, to treat acute septic conditions, or to care for painful injuries to the oral structures. Emergency dental care is authorized worldwide for personnel of all categories.

Patient categories authorized treatment. Dental care is authorized for various categories of persons at Air Force dental facilities subject to the following limitations:

a. Active duty military personnel. Air Force personnel and other members of the uniformed services on active duty are authorized general dental attendance in Air Force dental facilities. Uniform service members must use the facilities of the parent organization or service if the facilities are available and capable of providing the care required. Personnel of one service assigned to duty with another service are given outpatient treatment on the same basis as personnel of the service providing the treatment.

b. Retired members of the uniformed services. Retired members of the uniformed services are authorized the same care as active duty members of the uniformed services. This care is subject to mission requirements, availability of space and facilities, and capabilities of the dental staff. The base dental surgeon decides how much treatment to provide retired military personnel.

c. Family members. Family members are not authorized routine dental treatment at Air Force facilities in the United States, except where the Department of Defense has decided that adequate civilian sources of treatment are not available. At bases in the United States where family members are authorized routine dental care, the first priority of care after the dental needs of active duty members have been met goes to the family members of such members and then to family members of members who died while serving on active duty. Any remaining capability goes to retired members and their family members and family members of members who died while in a retired status. The base dental surgeon determines the availability of staff, facilities, and space to give such treatment.

All family members are eligible for diagnostic dental radiographs at any base dental services if the dental surgeon decides there are adequate space, facilities, and staff available.

d. Civilian personnel. Dental care provided to eligible civilian beneficiaries is generally limited to emergency treatment. Reimbursement is obtained for dental treatment on a "per-visit basis."

Exercises (402):

1. If a person in civilian clothes requests treatment in your dental clinic, what is the easiest way to determine his or her eligibility for treatment?

2. Match the dental care needed in column A with the proper type of dental attendance (general or emergency) in column B.

Column A	*Column B*
_____ (1) Replacement of missing teeth essential to performance of military duty.	a. General attendance.
_____ (2) Painful injuries to oral structures.	b. Emergency attendance.
_____ (3) Surgical procedures.	
_____ (4) Replacement of missing teeth that are essential to personal appearance or to the proper mastication of food.	
_____ (5) Restoration of lost tooth structure.	
_____ (6) Dental exams and advice on dental health.	
_____ (7) All corrective and preventive services.	
_____ (8) Dental care rendered for humane reasons to relieve pain or for acute septic conditions.	

3. What type of dental attendance is authorized for active duty members of the Army, Navy, or Marines at Air Force dental facilities?

4. Subject to mission requirements, availability of space and facilities, and capabilities of the dental staff, what members of the uniformed services are authorized the same dental care as are active duty members?

5. Indicate in the blanks provided the correct order of priority for dental attendance at bases where family member dental care is authorized. (Some of the categories listed have the same priority.) Number your responses with number 1 being first priority.

_____a. Retired members.
_____b. Family members of active duty members.
_____c. Family members of retired members.
_____d. Active duty members.
_____e. Family members of members who died while on active duty.
_____f. Family members of members who died while on retired status.

6. Who must make the determination as to the availability of space and facilities and the capabilities of the dental staff to provide authorized family members dental care?

7. Subject to the availability of space, facilities, and staff capabilities, what diagnostic service is authorized for all dependents at all bases?

8. What generally limited care is provided to eligible civilian beneficiaries?

403. State procedures and forms used in the scheduling of patients.

Scheduling Patients. Once you know the patient's eligibility and the type of dental attendance to provide, you can schedule an appointment. As we said earlier, dental procedures vary from clinic to clinic; but there are similarities in handling appointments. Each clinic uses an appointment book and an appoint slip, and, in most cases, bases its systems on an incremental time period. Appointment schedules may be arranged to provide treatment of military and dependent personnel (when authorized) at different hours during the day, or even on different days of the week.

Sometimes it's necessary to arrange appointments by priority. For example, when manning or equipment are short or when a person is going to a remote assignment and must have a dental clearance. You also need to be careful when scheduling appointments that you limit a patient's advance appointments. You want to keep a person's waiting time for a appointment to a reasonable length of time to minimize the number of broken appointments. This also leaves your clinic with enough time to handle any emergency cases.

Completing forms. Some clinics use AF Form 1223a, Dental Appointment Register, to keep a central appointment book at the reception desk. This form has an unnumbered hour and minute columns on both side and can be used to schedule appointments for eight operators for 1 day or one operator for 8 days. When you use AF Form 1223a, enter the patient's name under the operator's and the patient's organization designation under "unit." The advantages of a single appointment book is that it relieves the professional sections of appointment administrative duties and the clinic's professional sections don't have to answer calls about appointments. The book also provides a ready guide to let the receptionist draw the patient's records from the files before the day's appointments.

In some clinics, dentists use AF Form 1223, Dental Appointment Register, to keep their own appointment book. This system lets the dentists work out appointments to fit the patient's treatment needs.

When scheduling appointments in the appointment book make sure you do so accurately. Then, complete the patient's appointment slip. If you fail to do these two things and if you don't do them accurately, you could have more than one patient report for an appointment at the same time.

AF Form 490, Medical/Dental Appointment, is used for dental appointment slips. As an appointment is issued, record it on this form. You should fill out the form completely. Enter the person's name, grade, organization, date and time of the appointment, date issued, clinic to which the patient is to report, clinic phone number, and dentist with whom the appointment is made. Also, initial the form to verify the appointment. By doing all this, you provide a means of easily coordinating dental appointments with the individual's organization. You also benefit as a result of patients punctually meeting their scheduled appointments.

A policy can be adopted of reappointing patients to the same operator for all subsequent treatment of the same character. This policy is particularly applicable to restorative dentistry patients. On the other hand, a policy of reappointing patients to the next available open time may be preferable. Another alternate is to keep a few appointments open, thus permitting some flexibility in the dental officers schedule, allowing him or her to take care of unforeseen situations that may arise from time to time.

Broken appointments. Broken appointments result in a loss of man-hours for dental officers and technicians and should be kept to a minimum. You can help eliminate them by impressing upon patients the importance of keeping appointments. An active liaison between the Base Dental Service and the organizational units will also help minimize the problem.

283

Exercises (403):

1. What is common about all dental clinic appointment systems?

2. Who decides the priority of dental appointments when circumstances require a priority system?

3. What form is used by clinics to keep a central appointment book?

4. What form is used at clinics where each dentist keeps a personal appointment book?

5. What form is used for dental appointment slips?

1-2. Examination and Classification Standards

The dental examination is one of the basic professional services provided by the Air Force Dental Service. Soon after you entered the military service, you received your first dental-oral examination to determine your dental health. Throughout your service with the Air Force, you will receive periodic dental examinations. The results of these examinations are recorded on your individual dental health record. This record serves as a reference when you visit Dental Services.

404. State why the periodic dental examination is conducted; and cite action taken by the CBPO, the dental clinic, and organizational units in connection with this examination.

Periodic Examination Requirement. A periodic dental examination and a dental health record review are made to insure the currency of the dental health classification, to make early detection of dental-oral pathology, and to check the proper custody of the dental health record.

Consolidated base personnel offices (CBPOs) furnish the dental clinics with rosters of officers and airmen by their organizations and date of last examination. The CBPOs also furnish the organizational units with rosters and periodic dental examination notification cards. The dental clinic screens the dental health records and advises the organizational unit of the personnel who require a dental examination. The unit then coordinates the scheduling with the dental clinic, annotates the notification cards to advise members when to report for examinations, and sends the annotated cards to the members. A Type 2 examination is scheduled for personnel on the roster who have had less than a Type 2 or have had no dental examination in the past 3 months. If bitewing radiographs were taken during the past 12 months, a Type 3 examination may be substituted by the examining dentist. AFM 162–421, *Base Dental Service Reporting System,* and AFM 30–130, *Base Level Military Personnel System,* are the primary reference sources for managing and reporting the Periodic Dental Examination Program (PDEP). If you are involved in the PDEP, you need to be thoroughly familiar with these directives.

Exercises (404):

1. Give three reasons for conducting the periodic dental examination and dental health record review.

2. What actions does CBPO take before scheduling a periodic dental examination?

3. What steps do the dental clinic personnel then take following CBPOs action?

4. What three actions do organizational unit personnel take in regard to the periodic dental examination after they receive data from the CBPO and the dental clinic?

405. Identify the types of dental-oral examinations and clarify their use.

Dental-Oral Examinations. To insure uniformity in nomenclature and definitions, dental examinations are classified by type. The dentist has considerable latitude in deciding what examination to do, except where directives are specific. There are five types of dental examinations. Types 1, 2, 3, and 5 are recorded on the appropriate dental records. The Type 4 examination is a screening survey used to classify and not to record individual defects and abnormalities. The Type 5 screening examination is a modification of the Type 4 examination. A brief explanation of the five types of examination follows:

Type 1 examination (DOD Code 00140). This is the ideal examination, for it is the most comprehensive dental examination performed. It is an extensive examination of all hard and soft tissues, periodontal probing of all existing teeth, review of new or existing full-mouth intraoral periapical or panoramic radiographs with posterior bitewing radiographs, and formulation of a comprehensive treatment plan. The professional discretion of the examining dental officer and the availability of equipment dictate if new radiographs are required. When indicated, specialty consultations, other radiographs, diagnostic casts, transillumination, percussion, electrical or thermal tests, and other diagnostic procedures should be included. Because this examination is so comprehensive, it is not always practical to do it for all patients.

Type 2 examination (DOD Code 00120—periodic oral examination). This type is a routine examination and is the next most detailed examination. It is a mouth-mirror and explorer examination with adequate artificial lighting and posterior bitewing radiographs. When indicated, periapical radiographs are made. A periodontal screening examination is performed when the dental officer feels that it is needed.

Type 3 examination (DOD Code 00130—other examination). A Type 3 examination consists of a mouth-mirror and explorer examination, using either adequate natural or artificial lighting. This is a generalized examination of all hard and soft tissues. It includes emergency oral examinations for evaluation of pain, trauma, or defective restorations, the DOD-directed Preventive Dentistry Program for Children, and food handlers if requested. Selected area radiographs may be used.

Type 4 screening survey (DOD Code 00133—screening examination). The Type 4 examination consists of a mouth-mirror and explorer or tongue depressor examination with whatever illumination is available. It is most frequently used as a dental survey and to determine the need for oral hygiene instructions for personnel. The purpose of the screening, such as oral cancer screening, etc., is entered in the dental treatment record (SF 603).

Type 5 screening-entry into service (DOD Code 00133—screening examination). The Type 5 examination (used to initiate a member's dental record) consists of panoramic radiograph. The photograph must include both dental arches from the entire occlusal aspects. When this type of examination is used by the military processing center, it must be followed by a Type 2 or Type 3 examination at the time the patient first receives either definitive treatment or a periodic dental examination.

Exercises (405):

1. Why are dental examinations classified by type?

2. What is the most comprehensive type of dental examination performed?

3. When is the periodontal screening examination performed as a part of the next most detailed type of examination (the routine Type 2 examination)?

4. What type of examination provides an excellent way of determining the need for oral hygiene instructions for the personnel of a base?

5. What does Type 5 screening—entry into service examination consists of?

406. Identify classifications used to indicate a patient's dental health.

Dental Classifications. The Air Force Dental Service has a uniform system for recording the results of a dental examination. It is a classification system that lets the operator determine the dental status of each individual and establish priorities of treatment. It keeps the base dental surgeon informed of the dental health status of the base. Capital letters are written to record the classification. Each classification is carefully determined in accordance with the prescribed criteria and is accurately recorded. A description of each classification follows:

Class A. This classification is for those persons requiring no dental treatment.

Class B. This classification is for those persons requiring dental treatment.

Class C. This classification is for those persons whose dental health is unknown. It is a computer assigned classification for individuals who have not had a dental examination during the preceding 15 months. It indicates a requirement for a prompt determination of the current dental health status of active duty personnel. Change to another classification is made as soon as the person has been examined or dentally classified. The patient's current dental class must be recorded on his or her dental treatment record.

Exercises (406):

Indicate the dental classifications that are written on the dental health record by writing A, B, or C in the blank before each item below.

_____ 1. This classification is assigned by computer for individuals who have not been examined during the preceding 15 months.

_____ 2. This classification is for individuals who require teeth to be restored or other necessary dental procedures accomplished.

_____ 3. This classification is for individuals who do not require any dental work.

1-3. Maintaining Dental Treatment Records

Everyone in the U. S. Air Force has a dental record. A dental record is a chronological record of examinations, evaluations, and treatment received during a member's military career. This record may serve as a means of treatment planning, for casualty identification, or as a basis for VA benefit claims after a member leaves the military service. In this section, we will cover the responsibility for dental records, the contents of the records, and the filing procedures. AFR 162–1, *Management and Administration of USAF Dental Activities*, presents the requirements in recording patient's diagnoses, authorized abbreviations, and teeth designations.

407. Specify individual responsibilities for the maintenance of dental health records.

Responsibility for Dental Records. While anyone who handles a patient's dental record is responsible for that record, there are some specific areas of responsibility within the dental clinic. In this section, we will cover the primary custodial responsibility, the general responsibility, and the contents of the dental records.

Primary custodial responsibility. The base dental surgeon is the primary custodian of the dental treatment records. This person is responsible for the preparation, maintenance, use, and protection of all dental health records. In some cases your office will have to handle the dental health records of Navy, Marine Corps, and Army active duty personnel. Treat them in the same manner as you would the records of Air Force active duty personnel. However, you may need to make some modifications so as to conform with appropriate Army and Navy regulations.

When it is not administratively feasible for the dental treatment facility to maintain custody of the dental treatment records, the base dental surgeon may recommend that they remain with the custodian of the unit personnel records group.

General responsibilities. Dental officers must see that treatment of facility's dental records include accurate and appropriate entries of all professional services given. To do this, they must know the regulations and directives governing the preparation of dental records. Because these records are used by various persons and agencies for professional and administrative purposes, uniform terminology is necessary. Other personnel, including the receptionist, appointment clerk, records clerk, and dental assistants and technicians, may be charged with making the entries and filing the records.

Exercises (407):

1. Speaking in general terms, who can we say is responsible for a dental health record.

2. Who is the primary custodian of the dental treatment records?

3. Who is responsible for the preparation, maintenance, or use of the dental treatment records?

4. When may the base dental surgeon allow dental treatment records to remain with the custodian of the unit personnel records group?

5. Who is responsible for seeing that dental records include accurate and appropriate entries of all professional services given?

408. Identify which items in a list of dental health record materials are permanent-type records and which are temporary.

Contents of the Treatment Record Folder. You'll find the data you need to provide a comprehensive treatment record of a patient's dental condition and treatments in the Treatment Record (AF Form 2100 series). This record folder has the permanent dental records for all categories of patients. Handle it with care. Don't mutilate it by doing any unauthorized taping or stapling.

Permanent records. The permanent records in the patient's Treatment Record folder are:

a. SF 603, Health Record-Dental, and SF 603A, Health Record-Dental-Continuation.

b. AF Form 696, Dental Patient Medical History.

c. AF Form 935, Periodontal Diagnosis and Treatment Plan.

d. Consultant and Laboratory reports and similar records.

e. Initial full mouth and panorex radiographs.

f. DD Form 2005, Privacy Act Statement-Health Care Records.

Temporary records. Temporary records are considered transitory documents. They have no specific professional value once the information that they contain is entered into the permanent record. These include:

a. Temporary SF 603, Health Record-Dental.

b. SF 513, Medical Record-Consultation Sheet, when it is used for treatment planning.

c. AF Form 644, Record of Dental Attendance.

Exercises (408):

1. What type of documents are temporary records considered to be?

2. What folder contains a comprehensive record of a patient's dental condition and treatments?

3. Complete the items below by indicating whether each is a permanent or a temporary portion of a patient's dental health records. Identify permanent items with a P and temporary items with a T.

_____a. AF Form 696, Dental Patient Medical History.
_____b. Initial full mouth and panorex radiographs.
_____c. SF 513, Medical Record-Consultation Sheet, when it is used for treatment planning.
_____d. AF Form 644, Record of Dental Attendance.
_____e. Consultant and Laboratory reports and similar records.
_____f. AF Form 935, Periodontal Diagnosis and Treatment Plan.

409. Identify the categories involved in filing methods, and clarify procedures followed in maintaining dental treatment records.

Filing Procedures. To insure that the treatment sections can have dental records when they need them, there are procedures for storing the records systematically. You should be familiar with these storage procedures so that you can locate the records you need and file them so that others can do likewise. In covering filing procedures, we will consider: (1) the categories involved in filing methods and (2) radiographic filing procedures.

Categories involved in filing methods. The filing method is dependent upon the filing system used at your clinic. The first step in the filing procedure is to sort the records by filing category. You will be concerned with the following categories:

- Air Force active duty military personnel.
- Army active duty military personnel.
- Navy and Marine Corps active duty military personnel.
- Nationals of foreign governments.
- All other personnel.

Normally you will file records of each individual within a filing category by the terminal digit filing method. This method is based upon the person's Social Security account number.

Radiographic filing procedures. Since radiographs are a major diagnostic aid in patient treatment, it is important that they be included in the patient's dental record. Lost or misplaced radiographs cause particular problems, since treatment might be delayed until they are located or it might be necessary to take additional radiographs; additional radiographs would, of course, expose the patient to unnecessary doses of radiation.

The radiographs common to the Dental Services are the periapical, bitewing, occlusal, and extraoral films. You should use cardboard mounts that are available for bitewing and full-mouth series radiographs. These mounts hold the radiographs for easy viewing and provide for identification of the radiographs when the required patient data are entered on the mount. Small envelopes are available for occlusal films and periapical films that are not part of a full-mouth series and should be used. These envelopes also provide space for entering identifying patient data. Be sure that the patient identification data is complete, since they can serve to identify the radiographs if they become separated from the dental treatment folder.

Radiographs should be stored in a patient's dental treatment record in such a way that film loss is held to a minimum. A common method of storing film is by attaching a 5 × 7-inch envelope to the inside of the folder in such a manner that the folder must be opened to remove the contents. Since radiographs stored in this way cannot fall out of the folder during transportation or filing, the loss of radiographs is greatly reduced. The X-ray folder should be initialed by the attending dental officer.

Exercises (409):

1. Into what five categories can records be sorted as a first step in the filing procedure?

2. In what order are records of each individual within a filing category *normally* filed?

3. What are the differences between: (a) the methods of filing bitewing and full-mouth series radiographs and (b) the method of filing occlusal and periapical films that are not part of a full-mouth series?

4. Explain why radiographs are best stored in a 5 × 7-inch envelope attached to the inside of a patient's dental treatment folder in such a way that the folder must be opened to remove the contents of the envelope.

1-4. Completing Dental Treatment Forms

The purpose of dental treatment records is to make available the important information about a patient's dental care. The record is designed to keep the repetition of diagnostic procedures to a minimum. Since these records are suppose to contain all relevant dental care information, you must be prompt and accurate in filling out the various record forms. You will find in the next few pages that there are a number of these forms. You should fill them out using authorized abbreviations and charting symbols.

410. Given a list of specific teeth receiving treatment, identify the teeth using authorized abbreviations.

Authorized Abbreviations. Because of limited space on dental treatment forms, you need to use authorized abbreviations whenever possible. If, however there is room for misinterpreting an abbreviation, write out a complete description of the dental operation.

There is also a numbering system to help you identify the teeth receiving treatment. By using the numbers 1 through 32, you can locate the particular tooth or area concerned. When numbering the teeth, always start with the maxillary right third molar, which is designated as #1. Then number consecutively around the maxillary arch to the maxillary left third molar, which is designated as #16. Now, drop down to the mandibular left third molar, which is designated as #17. Then number around the lower arch to the mandibular right third molar, which is designated as #32. If a tooth is missing, always use the # symbol before each tooth number or series of tooth numbers, for example: #17 or #17, 18, 19. The designation of the teeth and their numbers follow:

Maxillary, Right Side		*Maxillary, Left Side*
#1	Third molars	#16
#2	Second molars	#15
#3	First molars	#14
#4	Second bicuspids	#13
#5	First bicuspids	#12
#6	Cuspids	#11
#7	Lateral incisors	#10
#8	Central incisors	# 9

Mandibular, Right Side		*Mandibular, Left Side*
#32	Third molars	#17
#31	Second molars	#18
#30	First molars	#19
#29	Second bicuspids	#20
#28	First bicuspids	#21
#27	Cuspids	#22
#26	Lateral incisors	#23
#25	Central incisors	#24

In addition to using numbers to identify teeth, you can find the surface of a tooth treated by using the first letter of the surface. The tooth surfaces and their abbreviations are:

M	Mesial
I	Incisal
O	Occlusal
D	Distal
F	Facila (buccal and labial)
L	Lingual

When more than one tooth surface is involved, use a combination of the abbreviating capital letters. An example of this would be #9–MID, which indicates a maxillary left central incisor, mesio-inciso-distal surfaces. Always place a dash between the tooth number and the surface.

The abbreviations given below are the more commonly used diagnoses, operations, restorations, and prostheses. You don't have to use these abbreviations, but it is desirable. This is for the previously stated purpose of saving clerical time and records space. In addition to these abbreviations, you can use simple chemical formulas for commonly used medications, such as Ca (OH)^2 for calcium hydroxide. When recording procedures, first record the diagnosis (if applicable), then the treatment performed.

Abrasion	Abr
Abscess	Abs
Acrylic Resin	Acr
Adjust(ed, ment)	Adj
Alveolectomy	Alvy
Amalgam	Am
Anesthesia General	Anes Gen
Anesthesia, Regional	Anes Reg
Apicoectomy	Apcy
Artificial	Ar

Base	B
Bitewings	BW
Calculus	Cal
Caries	Car
Caries Prevention Treatment, Stannous Flouride	CPTSNF
Cement	Cem
Complete	Com
Crown	Cr
Cystectomy	Cstmy
Deciduous	Dec
Defective	Def
Denture	Dtr
Drain	Drn
Dressing	Drs
Equilibrate (ation)	Equil
Eugenol	Eug
Exposure	Exp
Extraction (Tooth Removal)	Ext
Fixed	Fx
Fixed Partial Denture	FPD or Fx Pr Dtr
Fracture(s)	Frac
Gingival (itis)	Ging
Gingivectomy	Gtmy
Gutta Percha	GP
Heavy	Hvy
Impacted (tion)	Imp
Impression	Impr
Incised	Inc
Incomplete	Incom
Inlay	Inl
Inserted	Ins
Mandibular	Man
Maxillary	Max
Medium	Med
Necrotizing Ulcerative Gingivitis	NUG
Parietal	Par
Partial	Pr
Periapical	Per
Pericoronitis	Percor
Periodontitis	Pedoni
Periodontosis	Pedono
Polish	Pol
Porcelain	Porc
Postoperative Treatment	POT
Prepared (ation)	Prep
Preventive Dentistry Counseling	PDC
Prophylaxis	Pro
Pulpitis	Pitis
Radiograph	XR
Reappoint(ment)	Reapt
Recement(ed)	Recem
Reexamination	Reexam
Reference	Re
Reinforced Acrylic Resin Pontic	RAP
Reline	Rel
Removable Partial Denture	RPD or Rem Pr Dtr
Removal(ed)(able)	Rem
Repaired	Rpd
Restoration(s)	Res
Root Canal	RC
Sequestrum	Seq
Silicate	Sil
Slight	Slt
Stomatitis	Stom
Surgical	Surg
Suture(s)(d)	Su
Temporary	Tem
Treatment	Tr
Unerupted	Uner
Varnish	VAR
Zinc Chloride	ZnCl
Zinc Oxide	ZnO

Exercises (410):

1. When should you *not* use an abbreviation on records of dental treatment?

2. Complete items a through i by entering the number that designates each of the following teeth:

_____ a. Maxillary right second molar.
_____ b. Mandibular left first bicuspid.
_____ c. Maxillary left cuspid.
_____ d. Maxillary left central incisor.
_____ e. Maxillary right first bicuspid.
_____ f. Mandibular left third molar.
_____ g. Maxillary right first molar.
_____ h. Mandibular right central incisor.
_____ i. Mandibular left cuspid.

3. What abbreviation is used to indicate the mesio-occlusal distal-facial surface?

4. Complete items a through s by placing the authorized abbreviation of each term in the space provided.

_____ a. Equilibrate (ation).
_____ b. Radiograph.
_____ c. Periodontitis.
_____ d. Abscess.
_____ e. Unerupted.
_____ f. Temporary.
_____ g. Repaired.
_____ h. Gutta Percha.
_____ i. Parietal.
_____ j. Mandibular.
_____ k. Necrotizing Ulcerative Gingivitis.
_____ l. Abrasion.
_____ m. Calculus.
_____ n. Alveolectomy.
_____ o. Partial.
_____ p. Gingivectomy.
_____ q. Postoperative Treatment.
_____ r. Denture.
_____ s. Pulpitis.

5. Using authorized abbreviations, write the correct method of recording the procedures given in items a through e.

   a. The patient has mesio-occlusal caries of the maxillary left second bicuspid. Treatment consisted of removing the caries and inserting a base material and an amalgam restoration.

   b. The patient has mesio-occlusal-distal caries of the maxillary right first molar. Treatment consisted of removing the caries and inserting a base material and an amalgam restoration.

   c. The patient is suffering with acute pulpitis of the maxillary right first bicuspid. The treatment consisted of placing a zinc oxide and eugenol filling.

   d. The patient has a defective mesio-occlusal-distal restoration on the deciduous mandibular left second molar. Treatment consisted of removing the old restoration and replacing it with a new amalgam restoration.

   e. The patient is suffering from an acute and a severe periapical abscess of the maxillary right central incisor. Treatment consists of removing the tooth. Regional anesthesia was administered.

411. Given a chart showing the surfaces and roots of various teeth, and a list of dental conditions, mark the chart with the symbols used to depict these conditions.

Charting Symbols. Although you are probably familiar with the frequently used charting symbols, a comprehensive review is always useful. Figure 1-1 shows charting symbols that are used to depict missing teeth and existing restoration, while figure 1-2 shows charting symbols that illustrate diseases and abnormalities.

If you compare the entries in figures 1-1 and 1-2, you will find that some of these symbols may be used to indicate either a defect or a restoration. Such double use of a single symbol will not however, result in confusion on SF 603, as separate charts are provided for defects and restorations. Any attempt to use the symbols to chart dental records that have only a single chart will make it impossible to determine whether the symbol is intended to show a defect or a restoration.

Charting missing teeth. The guidelines for charting missing teeth are:

a. Edentulous arch or mouth. Inscribe two crossing lines, each running from the uppermost aspect of one third molar to the lowermost aspect of the third molar on the opposite side.

b. Individual missing teeth. Draw an X on the root or roots of each natural tooth that does not appear in the mouth at the time of examination. This applies to unerupted, extracted, or congenitally absent teeth, regardless of whether they have been replaced by fixed or removable partial dentures.

c. Deciduous teeth. If only the deciduous tooth is present, inscribe a block letter D around the number of the corresponding permanent tooth. If both the deciduous tooth and the permanent tooth are present, show their relative positions on the chart. Indicate the position of the deciduous tooth by placing the number of the permanent tooth in the relative position that the deciduous tooth occupies; etch a block letter D around it.

Charting restorations. In the diagram of the tooth, draw the restoration and show the approximate size, location, and shape (fig. 1-1). Identify restorative materials and prostheses in accordance with the instructions below:

a. Amalgam restoration. Outline and block in solidly. Chart proximal restorations in posterior teeth on facial and lingual surfaces only when the restoration extends onto these surfaces.

b. Single gold restorations. Outline and inscribe horizontal parallel lines within the outline of the restoration.

c. Nonmetallic (Silicate, Porcelain, Composite, Acrylic) restorations, artificial crowns, and facings. Draw only outline of size, location and shape of restoration, and each aspect of the crown or facing.

d. Combination restoration. Outline area showing approximate overall size, location, and shape; partition at junction of materials used. Show each type of material used.

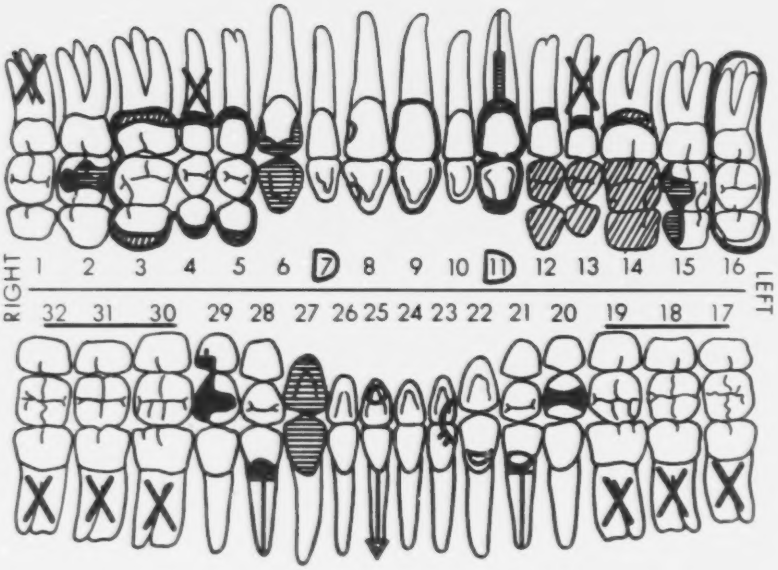
e. Post crown. Outline each nonmetallic material and show restorative metallic materials. Outline approximate size and position of the post or posts.

f. Root canal filling. Outline each canal filled and block in solidly.

g. Apicoectomy. Draw a small triangle, apex away from the crown and baseline at the approximate line of the root amputation.

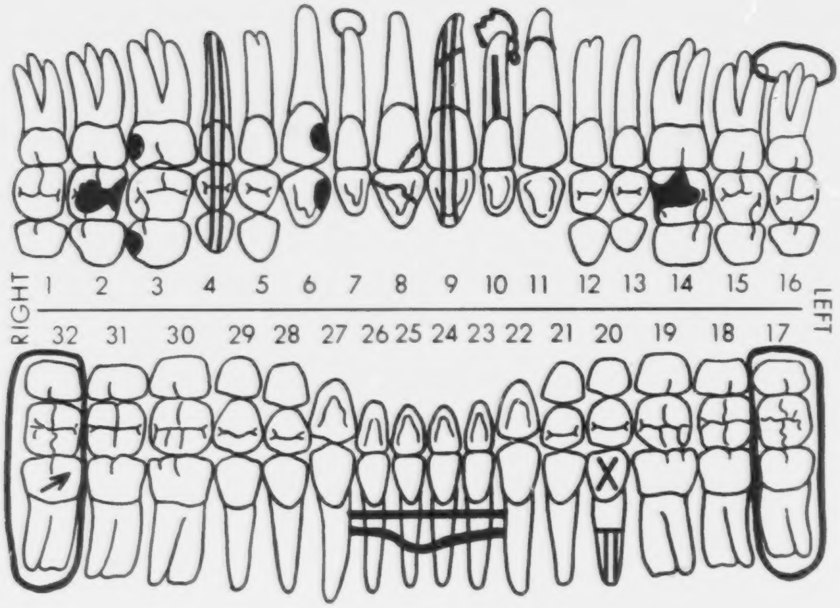
h. Overdenture abutment. Draw horizontal line at the approximate root length. Block in solidly to show root canal filling. If amalgam restores the abutment, show size and location by blocking solidly. If precious metal coping, sketch restoration and fill with horizontal lines.

i. Dentures. Place a horizontal line between the outline of the teeth and the numerals designating teeth replaced by removable partial dentures only. Under "Remarks" describe complete and removable partial dentures, indicating whether maxillary or mandibular and the type of



1. Missing Tooth
2. Combination Restoration, Amalgam and Gold.
3, 4, 5. Ceramo-metal Bridge, Complete Ceramic Coverage.
6. 3/4 Gold Crown.
7. Decidious Tooth 7 present. If permanent 7 is impacted, circle as shown for # 16.
8. Distal Nonmetallic Restoration.
9. Nonmetallic Jacket Crown.
11D. Retained deciduous Cuspid between 10 and 11.
11. Root Canal, Gold Post and Ceramo-metal Crown.
12, 13, 14. Ceramo-metal Bridge, Ceramic facings only.
15. Mesio-Occluso-lingual Gold Inlay.
16. Impacted Tooth.
17, 18, 19 30, 31, 32. Extracted. Replaced by removable Partial Denture.
20. Mesio-Occluso-Distal Amalgam (MOD).
21. Root Canal and Overdenture abutment without Gold Coping.
22. Facial Non-metallic Restoration.
23. Disto-Incisal Non-metallic Restoration with Pins for Retention.
25. Root Canal and Apicoectomy. Lingual Non-metallic Restoration.
27. Complete Gold Crown.
28. Root Canal and Overdenture abutment with Gold Coping.
29. Disto-Occluso-Lingual Amalgam Restoration with Pin Retention.

Figure 1-1. Charting symbols for missing teeth and existing restorations.



#2. Mesio-Occlusal caries.

#3. Distul caries.

#4. Extraction indicated.

#6. Mesial Caries.

#7. Abscess Periapical.

#8. Fractured Crown.

#9. Fractured Root-Extraction indicated.

#10. Abscess and Fistula, underfilled root canal filling.

#11. Resorbed Root.

#14. Defective Restoration-Outline includes area of restoration to be replaced and defective area.

#16. Cyst involving #15 and #16.

#17. Unerupted Tooth. (if not visible in oral cavity, an "X" would appear on corresponding tooth on chart "Missing Teeth and Existing Restorations.")

#20. Residual Root requiring removal.

#23 through #26. Gingival Crest-Continuous line. Alveolar Crest-Continuous line.

#32. Impacted Tooth with mesial inclination. Direction of arrow will indicate degree of inclination.

Figure 1–2. Charting symbols for diseases and abnormalities.

restoration. State whether the restoration is serviceable or unserviceable, for example, Rem Pr Dtr Man (Acrylic and/or Gold, or Chrome-Cobalt) serviceable: or Dtr Com Max Acr, unserviceable.

j. Fixed partial dentures. Outline each aspect, including abutments and pontics. Show partition at junction of materials and show each material used as indicated above. Exception: Show gold by inscribing diagonal parallel lines instead of the horizontal parallel lines used to identify single gold restorations. Note defective fixed partial dentures under "Remarks," for example, Defective pontic #10 or defective 3/4 crown #11.

k. Remarks. Under "Remarks," add any other pertinent information relating to missing teeth and existing restorations.

Charting disease and abnormalities. Use the following guidelines for charting diseases and abnormalities. Make sure you don't enter these symbols in record areas designated for missing teeth and restorations. Entering these symbols in the wrong area would prevent differentiation between the caries and the restorations. (See fig. 1-2.)

a. Caries. On the diagram of the tooth affected, draw an outline of the carious portion, showing approximate size, location, and shape; block in solidly.

b. Extraction (removal) indicated. Draw two parallel vertical lines through all aspects of the tooth and roots involved. This applies also to unerupted teeth when removal is necessary. In case of a retained root, draw two parallel lines in the direction of the long axis of the root through the part that is retained.

c. Abscess or cyst. Outline approximate size, form, and location.

d. Fistula. Draw a straight line from the abscess area, ending in a small circle in a position on the chart corresponding to the location of the fistulous opening into the mouth.

e. Unerupted tooth. Outline all aspects of the tooth with a single oval.

f. Fractured tooth. Trace a jagged fracture line in the relative position on the crowns or roots. When removal is indicated, chart as outlined in b above.

g. Periodontitis and/or alveolar resorption. Indicate extent of gingival recession with a continuous line drawn across the roots in the areas involved. In the case of active periodontal disease, place an X in the proper box under "B. Periondontoclasia." Show the extent of alveolar resorption by drawing another continuous line across the roots of the teeth at the proper level, based on clinical and radiographic findings.

h. Resorption of root. Draw an even line showing extent of resorption of root. Note charting of fractured tooth as given in f above.

i. Defective restoration. Outline the defective restoration, including the carious or otherwise defective area, and block in solidly.

j. Inclination of impacted teeth. Place an arrow in the crown portion of the tooth form, showing the direction of the long axis of the tooth.

k. Abnormalities of occlusion and remarks. Describe malocclusion and any other pertinent remarks pertaining to diseases and abnormalities found. Comments about therapeutic radiation to the oral or perioral structures when considering prosthetic treatment are particularly noteworthy.

l. Special entries for identification. Record under "Remarks," findings such as erosion, abrasion, mottled enamel, hypoplasia, Hutchinson's teeth, rotation, irregularity of alignment, drifting or malocclusion of teeth, presence of supernumerary teeth, abnormal interdental spaces, mucosal pigmentation, leukoplakia, diastema, torus palatinus of mandibularis, embedded foreign bodies, and unusual restorations or appliances. These entries are important for diagnostic and identification purposes.

Exercises (411):

1. Record the following conditions by placing the proper symbols on figure 1-2A.

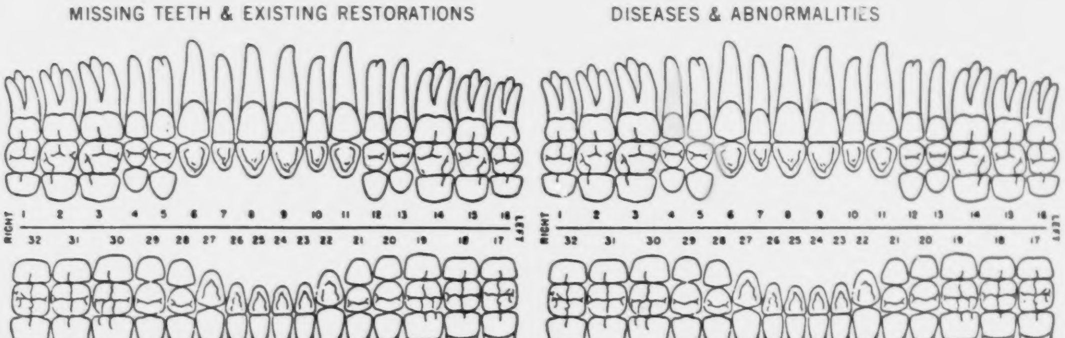


Figure 1-2A. Charting exercise (objective 411, exercise 1).

#1 Tooth missing.
#2 Mesio-occluso-lingual gold inlay.
#3 Defective distal-occlusal restoration.
#4 Extraction indicated.
#5 Open-faced gold crown.
#6 Nonmetallic jacket crown.
#7 Mesial nonmetallic restoration.

#8, #9, #10 Fixed partial denture. Three-quarter crown on #8 and #10 supporting a pontic replacing missing tooth #9 with a nonmetallic facing.

#11 Retained deciduous cuspid between permanent teeth #10 and #11.

#12 Cyst involving #12 and #11.
#14 Full gold crown
#15 Tooth missing.
#16 Unerupted tooth.
#17 Mesio-occlusal amalgam.
#18 Abscess periapical.
#19 Occlusal amalgam.

#20 and #21 Teeth missing, replaced by a removable partial denture.

#22 Lingual nonmetallic restoration. Root canal filling and apicoectomy.

#23 Mesial caries.

#24 and #25 Teeth missing, replaced by a removable partial denture.

#27 Residual root requiring removal.

#28 Mesio-occluso-distal caries.

#29 and #30 Teeth missing, replaced by a removable partial denture.

#32 Impacted tooth with 45° mesial inclination.

412. State procedures for preparing the Treatment Record Folder.

The Folder. Treatment records are kept in a special series of folders that are color coded and numerically designed for terminal digit filing, according to Social Security account numbers (SSANs). Since the folders are identified by SSAN, make sure you use the correct number and transcribe it correctly. If the patient is a dependent, use the sponsor's SSAN. Civilian employees and active or retired military members use their own SSANs.

The AF Form 2100-series folders are color coded on the following basis:

If the last two digits of the SSAN are	Use AF Form	Color of Folder
00–09	2100	Orange
10–19	2110	Green
20–29	2120	Yellow
30–39	2130	Grey
40–49	2140	Tan
50–59	2150	Blue
60–69	2160	White
70–79	2170	Brown
80–89	2180	Pink
90–99	2190	Red

Patient's name, status, and SSAN. After selecting the correct folder, use a pen, felt-tip marker, or typewriter to print the patient's first name, middle initial, and last name in the patient block on the front of the 2100 series folder.

Enter the last (ninth) digit of the appropriate SSAN to the right of the preprinted (eighth) digit in the upper right-hand side of the folder. After this, enter the remaining seven numbers of the SSAN to the left of the preprinted digit. These nine numbers make up the complete SSAN of the patient or of the patient's sponsor.

Relationship prefix. In the two spaces to the left of the SSAN, enter the relationship prefix code. It tells whose SSAN is being used. Use one of the following codes:

20—The patient's SSAN.
01—19—Sponsor's dependent children. (Note: Numbers are assigned in birth date order with the oldest child being assigned 01, the next oldest 02, etc.)
30—Sponsor's spouse.
40—Sponsor's dependent mother.
45—Sponsor's dependent father.
50—Sponsor's dependent mother-in-law.
55—Sponsor's dependent father-in-law.
60—69—Sponsor's other eligible dependents.
98—Civilian emergency.
99—Elsewhere classified.

Last digit of SSAN. Use a black ink pen or felt-tip marker and blot out the 1/2-inch square block (along the right edge of the back leaf of the folder) that corresponds to the last digit of the applicable SSAN.

Current year. For nonmilitary and retired military personnel, mark through the current year located on the right edge of the front leaf of the folder. This mark designates the latest year of treatment and determines the retirement date of the record.

Patient status. Use a black ink pen or felt-tip marker to blot out the Dental block on the front of the folder. For active duty military, blot out the "S" block (right edge). Use the "R" block on the side of the folder for Army personnel only. Also, blot out the "military block" on the front cover and enter the patient's service and rank in *pencil* in the space provided. For Reserves, enter "R" in the military block. For retired military, blot out "Retired Military" block and place the retired person's rank in the space provided. For dependents and civilians, blot out the "Nonmilitary" block.

Identify patients in the Air Force Reliability Program by entering the date the patient was placed in the program (in pencil). Erase the date when the patient is removed from the program.

Identify patients who are food handlers (Veterinary service) by entering the date of their last examination (in pencil) in the space provided on the front of the folder.

Flying personnel may include missile launch crewmembers, air traffic control personnel, physiological training personnel, parachute duty personnel, weapons controller personnel, etc. Mark their records with a strip of black tape on the right edge of the folder, extending from immediately below block "9" to the bottom of the folder. If you can't get black tape, use black ink or another appropriate marking device as an interim measure. Also, stamp the word "Fly" in 2-inch block letters in the upper left-hand corner of the front leaf of the folder.

Patients without SSANs. Some patients your facility treats will not have an applicable SSAN (such as emergencies, foreign nationals, or dependents of allied and neutral military). For these individuals build an arbitrary SSAN this way.

a. Last four digits are "9999" always.

b. First five digits are assigned in numeric sequence as a new patients report. The first patient requiring a constructed SSAN is assigned "SSAN" 000–01–9999; the second will be assigned "SSAN" 000–02–9999. (Note that members of the same family will have different numbers. Also, if a record is moved permanently to another facility, the new facility will assign a new number to the patient.)

c. The relationship prefix code is always "99."

Sensitivity. Identify patients with sensitivities by placing the word "sensitivity" just below the patient's ID data. Since this is a permanent entry, do it in ink. You also may use a stamp or label.

Exercises (412):

1. Treatment records are filed in terminal digit sequence based on what?

2. How is the color of the AF Form 2100 series selected?

3. What relationship prefix would you use to denote a patient as being the dependent mother of an active duty colonel?

4. What does the "S" and "R" on the right edge of the treatment folder represent?

5. How are patients in the Air Force Reliability Program identified?

6. How are the treatment records of an active duty captain *stamped* to show that he or she is on flying status?

7. What are the last four digits of the constructed SSAN for a patient for whom there is no SSAN?

413. State how treatment records are filed, checked, and transferred.

Terminal Digit Filing System. Recall from the previous text segment that you file treatment records numerically by terminal digit sequence. The SSAN on the folder is your primary reference when searching the file for a record. You'll find the records filed according to the groups of digits, working *from right to left* through the SSAN and the prefix. The number 00–500–40–51–99 would be filed first under 99 and, within that group, under 51. If there are other SSANs ending in 5199, proceed to the next group, 40. Continue working to the left through the groups until there are no duplications.

The central file is divided into approximately 100 equal sections, bearing the 100 primary numbers "00" consecutively through "99." After you file 100 to 200 charts, a pattern formed by color and blocking of folders usually will emerge. In a properly instituted and maintained terminal digit color coded and blocked filing system, it is impossible to misfile a record in an area greater than 1/100 of the total file area without the misfiled record being immediately visible. A folder misfiled with respect to the left digit of its primary number (for example, a "45" that has been inserted among the "55s") attracts attention because of its different color. If, within a color group, the diagonal pattern formed by the blocking is interrupted, it is because the folder whose blocking causes the break was misfiled with respect to the right digit of its primary number. For example, a "45" inserted among the "42" shows a break in the diagonal pattern.

Removing treatment records for patient care. When you remove a record from the file, prepare an AF Form 614, Charge Out Record. Insert the AF Form 614 into the file where you remove the record so that it is clearly visible when it is in the file. When you return the record, remove the AF Form 614.

Maintaining an alphabetical index. AF Form 1942, Clinic Index, is prepared for each treatment folder of nonmilitary and retired military personnel. These forms form an alphabetical index so that folders can be easily found in an emergency, or other situations, such as when the SSAN of the sponsor is not known. If the record is to be hand-carried to another treatment facility, complete the authorization on the back of the form.

Exercises (413):

1. Under the terminal digit filing system, how many primary sections does the file contain?

2. How can you tell whether a record is misfiled by the eighth digit of its SSAN? The ninth digit?

3. When you remove a record from a file, what should you put in its place?

4. For whom is AF Form 1942, Clinical Index, prepared?

5. What should be done on the back of AF Form 1942 when the treatment record is to be carried to a different treatment facility?

414. State procedures for exchanging dental health data and for disposing of dental health records.

Disposing of Dental Health Records. You'll find detailed instructions on how to dispose of dental health records and radiographs in AFM 12-50 (Tables 162-1), *Disposition of Air Force Documentation*, and AFR 35-44, *Military Personnel Records Systems*.

Active duty personnel. Sometimes active duty personnel and their records become separated. When this happens you can locate these people on the Worldwide Locator available on microfiche at the CBPO or the outpatient section of the medical treatment facility. Then, send the records to their current duty station.

Retired or separated personnel. When dealing with retired or separated personnel, hold on to their records until CBPO asks for them. Your office and the local CBPO should work a system that insures that the dental health records are included in the field record group.

Send any records you can't dispose as instructed above to AFMPC/MPCD003, Randolph AFB TX 78150. This office will take care of final disposition.

Dependents records. Keep the dental health records of family members in your active file for as long as you have the sponsor's record.

Exchange of data. Base dental surgeons may furnish dental information on personnel of other uniformed services directly to the responsible agencies of these services on proper request. Also, they may request similar data on Air Force personnel directly from other uniformed services. This action does not require prior approval.

The base dental surgeon may prepare duplicate copies of any records on request from an outside agency, or when it is necessary for the record to be with the patient. Procedures for releasing information are in AFR 12-30, *Air Force Freedom of Information Act Program*. Care must be taken to comply with the Privacy Act of 1974 and Title 21, U.S.C., Sections 401 and 1175.

Exchange of data between Air Force facilities may be required when a person receives treatment away from the record location, including a different facility on the same base. This information must be inserted in the patient's permanent record.

If a record is not available, treatment data may be sent on AF Form 644, Record of Dental Attendance. In completing this form, enter essential personal data to identify the patient. If you send treatment data by mail or messenger, enter the correct address of either the custodian of the patient's record or the patient's commander. Send this notation with treatment data on active duty military personnel: "For inclusion with Dental Treatment Records—Field Record Group."

Exercises (414):

1. When active duty personnel and their records become separated, how can you locate these individuals?

2. How long are dependent health records kept in the active file?

3. Who may prepare duplicate copies of any records on request from an outside agency, or when it is necessary for the record to be with the patient?

4. How can you send treatment data if the record is not available.

415. State how to use DD Form 2005, Privacy Act Statement—Health Care Records.

Privacy Act of 1974. The Privacy Act of 1974 requires that individuals from whom information is collected for inclusion in medical records be told how the information will be used and their rights, benefits, or obligations with respect to supplying the information. DD Form 2005, Privacy Act Statement—Health Care Records, must be filed in each medical/dental record located in an Air Force medical facility.

DD Form 2005 is not a consent form. It merely shows that the individual has been informed of the purposes and uses of the information collected and has been advised of his or her rights and obligations with respect to supplying the data. If an individual refuses to sign the form, say so on the form.

Record, date, and sign the form before filing it. File DD Form 2005 as the bottom document on the left side of the treatment record or as the last document in other records.

Exercises (415):

1. Of what must patients be informed when information is obtained for inclusion in the medical/dental record?

2. For whom must DD Form 2005 be initiated?

3. What action should you take if a patient refuses to sign DD Form 2005?

4. Where is the DD Form 2005 usually filed?

416. State the function of SFs 603 and 603A, Health Records—Dental, and explain certain entries made on these forms.

Dental Health Records, SFs 603 and 603A. The SF 603 is the basic permanent record of a patient's dental health and the treatment provided. It shows the patient's initial dental condition, the treatment received, and the current oral health status. (Refer to FO7, supplemental material, as we cover these forms.)

The SF 603A is a continuation sheet. You'll use it when there's no more space in item 17 of SF 603. When forced to use it, print the patient's name and SSAN on the side of the form. Section 15 shows symbols for treatment recorded in item 17 of the continuation sheet only. Transfer current treatment requirements from the old 603 item 16 to the 603A item 16.

When definitive care is provided to any patient (except the Children's Preventive Dentistry Program), complete Section 1 of the SF 603. Do items 4 and 5 when a military member begins treatment following a Type 5 examination of whenever these 603 is serving as the permanent record. Use item 4 to describe missing teeth and existing restorations and items 5 for diseases and abnormalities. Be accurate. Use the remarks section of items 4, 5, and 17 to note any treatment not previously charted.

Initiating Dental Health Records, SF 603 and 603A. Dental health records must be initiated for any of the following reasons.

Initial record. An initial Type 5 (code 00133) screening or Type 1 or 2 examination, as appropriate, is performed and recorded on SF 603 when a member enters a tour of extended active duty for more than 90 days. It provides a record of the member's dento-oral condition when he or she enters military service.

No record available. Initiate a dental health record when it has been determined that a record was never initiated, or that the record has definitely been lost. A Type 1, 2, or 5 examination is performed.

Short tour (Active Duty or Training). A dental health record is initiated when examination or treatment is required for military personnel on short tours of active duty or training periods at an Air Force installation.

Temporary SF 603. A temporary SF 603 may be initiated when it is necessary or desirable to do so. All information should be transcribed into the permanent records as soon as possible, and the temporary record is disposed of as prescribed by AFM 12–50, *Disposition of Air Force Documentation*. When the SF 603 is used as a temporary record, it must be plainly marked as such.

Dental identification. When an examination is performed specifically for dental identification purposes, use AF Form 697a, Dental Identification Chart, in place of SF 603. The form may be completed for special categories of civilian employees when such a requirement has been established locally.

Physical examinations. A new SF 603 solely for the separation examination is not required, but the member's current SF 603 must be updated and recorded with the entry, "Exam Type 3 (Separation)" under item 17. If the member's SF 603 is not available, send the examination data to the base where the record is filed using AF Form 644. The only dental entries required for the member's SF 88, Report of Medical Examination, made at the time of separation, are the type of dental examination, the dental health classification, and the notation: "See Dental Health Record." Insure any separation examination is accurate. Patients may need VA treatment for conditions existing at the time of their separation from active duty.

Maintaining Records. Dental health records are maintained according to the following guidelines:

(1) Military personnel are examined when they enter the service, and all dental records are included in the dental folder. These records are a permanent part of the individual's health record and are not removed.

(2) Subsequent examinations are recorded according to AFR 162–1, *Management and Administration of USAF Dental Activities*. For medical physical examinations, AFR 160–43, *Medical Examination and Medical Standards*, prescribes the purpose, standards, and when dental entries are made on SF 88.

(3) Enter all findings and abnormalities found by clinical, microscopic, and radiographic examinations.

(4) Enter authenticated information received from another department of the Federal Government or a civilian agency.

(5) Enter clinical evidence of unrecorded dental treatment received by military personnel.

(6) Only standard diagnostic terminology listed in AFR 162–1 may be used.

How to Complete SF 603 and 603A. The dental record is divided into three sections: I, Dental Examination; II, Patient Data; and III, Attendance Record. The charts and written entries of Section I are intended to reflect the dental-oral condition of the individual upon his or her entry into the military service. Under certain circumstances, it may be necessary to complete the subsection on Diseases, Abnormalities, and X-rays and the subsection on Missing Teeth and Existing Restorations at different times. Neither will be altered after definitive care has been started. Before that time, any errors noted in the record are corrected and initialed by a dental officer.

All dental treatment records maintained during the career of an officer or airman will accompany him or her on each change of station. When making entries on the dental record, use a typewriter if one is available; if a typewriter is not available, print the entries in black or blue-black ink. Use a pen with a fine point to clearly chart the examination and treatment rendered. Now, let's take a closer look at Standard Form 603. Refer to foldout 7, supplemental material, as we cover the 603 and 603A.

Section I, Dental Examination. This part of the form has five subsections. The first three are self-explanatory: Purpose of Examination, Type of Exam, and Dental Classification. The charting of the record begins in subsection 4, the chart of Missing Teeth and Existing Restorations. The chart in this subsection is completed, using the symbols illustrated in figure 1-1. This is the portion of the record that indicates all missing teeth and restorations at the time of the original examination. In the Remarks section, record appropriate comments to clarify the charted entries. In subsection 5, Diseases, Abnormalities, and X-rays, indicate any oral diseases or abnormalities detected during the initial examination. A space is provided on the right-hand side of the form for noting abnormalities of occlusion and remarks necessary to clarify the charted entries. Entries on this chart are made as illustrated in foldout 7.

Section II, Patient Data. This section is self-explanatory. Three entries in this section are made in pencil; all others should be typed or made in ink. The entries made in pencil are subsection 8, Grade, Rating, or Position; subsection 9, Organization Unit; and subsection 10, Component or Branch. All three of these may change from time to time; thus, penciled entries will make it easier to change the entries as appropriate. Always check the information in this section with the patient for accuracy and currency. This will insure that the record pertains to the patient you have in the chair.

Section III, Attendance Record. This section is divided into three subsections. In subsection 15, Restorations and Treatments, you chart the restorations completed during the person's military service. Use the symbols provided for the charting of Missing Teeth and Existing Restorations. Refer to figure 1-1 for these symbols. Subsection 16, Subsequent Diseases and Abnormalities, provides a chart for indicating the diseases and abnormalities that are found after the date on which the original dental examination was charted. When you make entries in subsection 16, use a pencil and the same symbols that are used to chart diseases and abnormalities. These symbols are shown in figure 1-2. The use of a pencil permits erasures of the symbols as the dental treatment is completed. The last subsection on the form is 17, Services Rendered. In this subsection, enter chronologically all diagnoses made and treatments rendered. For each treatment, indicate the patient's dental classification, the name and rank of the operator, and also the services rendered and authenticated with the initials of the operator. Also, record evidence of dental treatment noted on examinations but not verified in the records, together with the circumstances.

SF 603A, Health Record—Dental—Continuation. When space is no longer available for entering the treatment rendered, SF 603A, Health Record—Dental—Continuation, is initiated. There is no need to enter the existing individual restorations. Only the current treatment requirements should be entered in item 16.

Exercises (416):

1. Briefly describe and state the function of the dental health record.

2. When do you complete Section I of the SF 603?

3. List six reasons to open a dental health record.

4. Who initials corrections validly made in Diseases, Abnormalities, and X-rays and the Missing Teeth and Existing Restorations, subsections 4 and 5, respectively, of Section I of SF 603, before the time that definitive care has started?

5. Except for certain penciled entries, how do you enter things on the dental record when you don't have a typewriter?

6. What time is represented by that portion of the dental records that is charted with symbols (specifically, subsection 4, of the first section) and that indicates all missing teeth and restorations that existed at that time?

7. Give the subsection number and the names of the three subsections into which Section III, Attendance Record, is divided?

8. An SF 603A, Health Record—Dental—Continuation, is initiated when which subsection of Section III, Attendance Record (SF 603), has no space for entry left?

9. What is entered in items 15 and 16 of SF 603A?

417. Identify correct statements about the function of AF Form 696, Dental Patient Medical History.

Dental Patient Medical History. The purpose of AF Form 696 is to identify any medical problems that could affect or contraindicate the dental treatment of a specific patient. Because a medical history must be worked up for all patients before a course of treatment can begin, have your patients or their sponsors to fill out AF Form 696, Dental Patient Medical History, in ink. This form will let the examining officer check the medical history of the patient and evaluate all positive entries and record any findings in the space provided. The examinating officer signs in ink all health histories initially evaluated. (See fig. 1-3.)

All histories with relevant positive entries are retained in the patient's dental folder. Histories that were completed 2 years before the date of the latest history should be destroyed if there are no positive entries or entry changes.

When the dental officer decides that entries on AF Form 696 reveal conditions that require special attention in the dental clinic, stamp "See History" under the patient's identification block on the right side of the front of the AF Form 2100 series record. The type face of the stamp should be no smaller than 5/16 inch and not obliterate other displays in that area of the folder.

Exercises (417):

Indicate whether each of the following statements is true or false by writing a T or an F in the blanks provided. Explain any false answers.

_____ 1. AF Form 696 provides the dental officer a method of checking the medical history of a patient and identifying any problem that could affect or contraindicate the patient's dental treatment.

_____ 2. In a case when a patient has some sensitivity, the entry SENSITIVITY is stamped or written in black ink immediately under the patient's name on the AF Form 2100 series.

_____ 3. Dental patient histories should remain in the dental folder for 2 years, regardless of whether the information obtained was positive or negative.

_____ 4. Only positive histories 2 years old should be destroyed.

418. State the purposes of AF Form 644, Record of Dental Attendance; and complete a sample AF Form 644, given hypothetical information.

Record of Dental Attendance. AF Form 644, Record of Dental Attendance, has several major functions. It provides information to be transposed to the dental health record and for compiling statistical data for the automated reports. In addition, the data in the periodic dental examination program section is used to update the base-level personnel system (BLPS), thus making this patient encounter form an integral part of patient management.

AF Form 644 is also used if:

(1) The dental treatment records are not available, such as when a person receives dental treatment away from the base where his or her record is filed. In this case a duplicate signed copy of AF Form 644 is sent back with the patient to be placed in his or her record. The base treating the patient takes credit for the treatment given. The base receiving the duplicate AF Form 644 updates the patient's record and makes sure that an appropriate BPLS card reaches the CBPO.

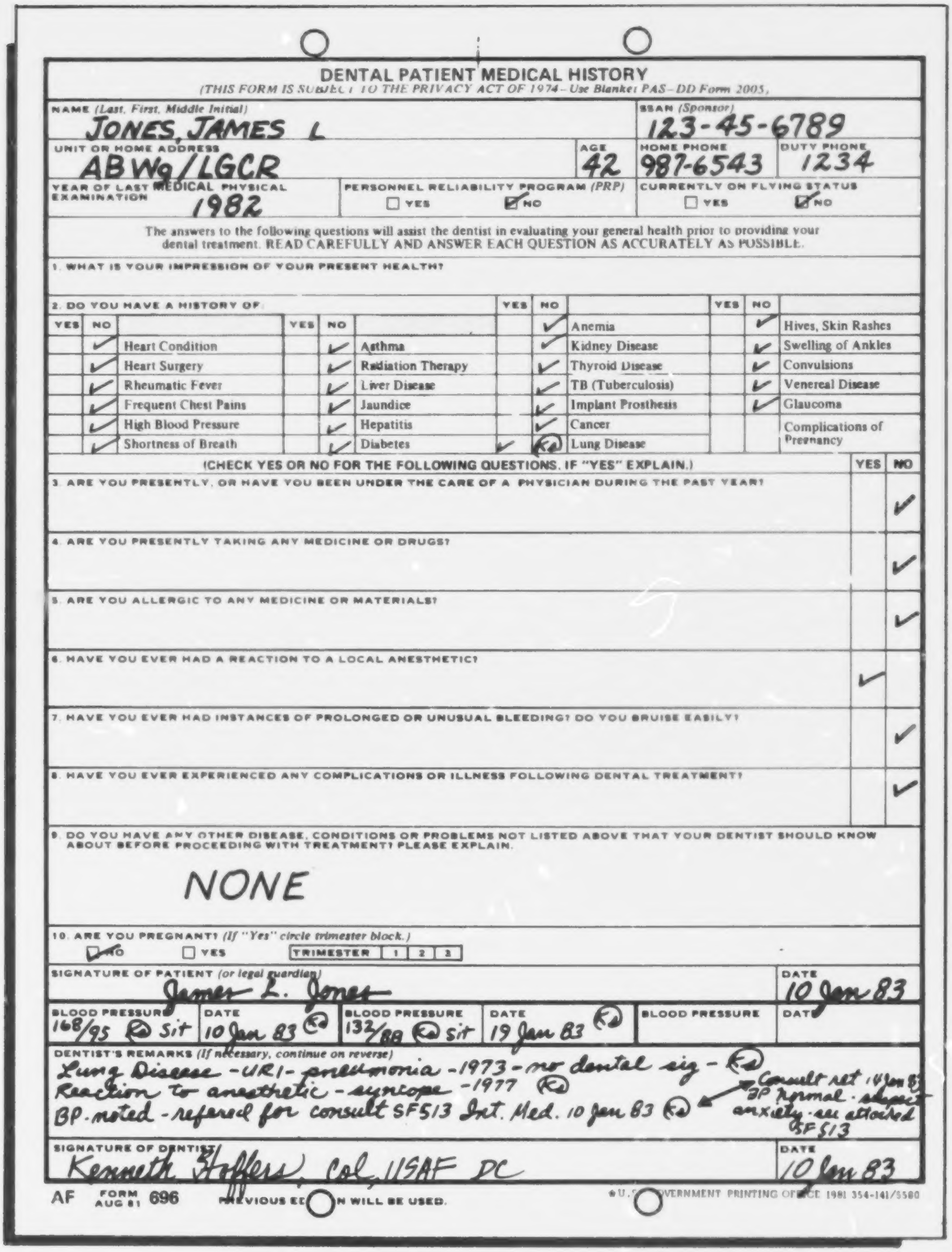
(2) A person receives treatment in one clinic and the record is on file in another clinic on the same base. In such cases, send AF Form 644 to the clinic maintaining the dental treatment records files.

(3) The dental treatment records remain with the field records group rather than in the facility and are not available at the time of attendance. Use AF Form 644 to record treatment. Transcribe data to SF 603 as soon as practical.

Completing AF Form 644. The AF Form 644 is divided into three sections: I, Data Automation; II, Patient Information; and III, Clinical Information. The dental technician or health care provider initiates AF Form 644. The records and reports section transfers information from the 644 to SF 603. AFM 162–421, *Base Dental Service Reporting System*, prescribes base statistical reporting.

As we cover the steps for completing AF Form 644 refer to figure 1-4.

(1) Section I, Data Automation, includes the trans type block (1) through the Date block (72–77). In the *trans type block (1)* place a "D" for dental. The *base code (2–5)* is a four-digit alpha code. The *clinic (6)* is the number of the clinic. The *supplement (7)* is left blank if only one 644 is used; however, enter a "2" on the second 644 used to code the same patient visit when procedures exceed the maximum number on the first 644. Under the *patient beneficiary type (8–9)*, check the appropriate box that classifies the patient. Under *Dental Procedures and Services (10–14) through (51–56*, enter the appropriate codes for the procedures shown in Section III, Clinical Information. *Periodic Dental Examination Program (57–58) through (72–77)* is used for active duty Air Force



DENTAL PATIENT MEDICAL HISTORY

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 – Use Blanket PAS – DD Form 2005.)

NAME (Last, First, Middle Initial) JONES, JAMES L			SSAN (Sponsor) 123-45-6789	
UNIT OR HOME ADDRESS ABWg/LGCR		AGE 42	HOME PHONE 987-6543	DUTY PHONE 1234
YEAR OF LAST MEDICAL PHYSICAL EXAMINATION 1982	PERSONNEL RELIABILITY PROGRAM (PRP) ☐ YES ☑ NO		CURRENTLY ON FLYING STATUS ☐ YES ☑ NO	

The answers to the following questions will assist the dentist in evaluating your general health prior to providing your dental treatment. READ CAREFULLY AND ANSWER EACH QUESTION AS ACCURATELY AS POSSIBLE.

1. WHAT IS YOUR IMPRESSION OF YOUR PRESENT HEALTH?

2. DO YOU HAVE A HISTORY OF:

YES	NO		YES	NO		YES	NO		YES	NO	
							✓	Anemia		✓	Hives, Skin Rashes
	✓	Heart Condition		✓	Asthma		✓	Kidney Disease		✓	Swelling of Ankles
	✓	Heart Surgery		✓	Radiation Therapy		✓	Thyroid Disease		✓	Convulsions
	✓	Rheumatic Fever		✓	Liver Disease		✓	TB (Tuberculosis)		✓	Venereal Disease
	✓	Frequent Chest Pains		✓	Jaundice		✓	Implant Prosthesis		✓	Glaucoma
	✓	High Blood Pressure		✓	Hepatitis		✓	Cancer			Complications of Pregnancy
	✓	Shortness of Breath		✓	Diabetes	✓	~~✓~~ KS	Lung Disease			

(CHECK YES OR NO FOR THE FOLLOWING QUESTIONS. IF "YES" EXPLAIN.)

	YES	NO
3. ARE YOU PRESENTLY, OR HAVE YOU BEEN UNDER THE CARE OF A PHYSICIAN DURING THE PAST YEAR?		✓
4. ARE YOU PRESENTLY TAKING ANY MEDICINE OR DRUGS?		✓
5. ARE YOU ALLERGIC TO ANY MEDICINE OR MATERIALS?		✓
6. HAVE YOU EVER HAD A REACTION TO A LOCAL ANESTHETIC?	✓	
7. HAVE YOU EVER HAD INSTANCES OF PROLONGED OR UNUSUAL BLEEDING? DO YOU BRUISE EASILY?		✓
8. HAVE YOU EVER EXPERIENCED ANY COMPLICATIONS OR ILLNESS FOLLOWING DENTAL TREATMENT?		✓

9. DO YOU HAVE ANY OTHER DISEASE, CONDITIONS OR PROBLEMS NOT LISTED ABOVE THAT YOUR DENTIST SHOULD KNOW ABOUT BEFORE PROCEEDING WITH TREATMENT? PLEASE EXPLAIN.

NONE

10. ARE YOU PREGNANT? (If "Yes" circle trimester block.)

☑ NO ☐ YES TRIMESTER 1 2 3

SIGNATURE OF PATIENT (or legal guardian) James L. Jones					DATE 10 Jan 83
BLOOD PRESSURE 168/95 KS sit	DATE 10 Jan 83 KS	BLOOD PRESSURE 132/88 KS sit	DATE 19 Jan 83 KS	BLOOD PRESSURE	DATE

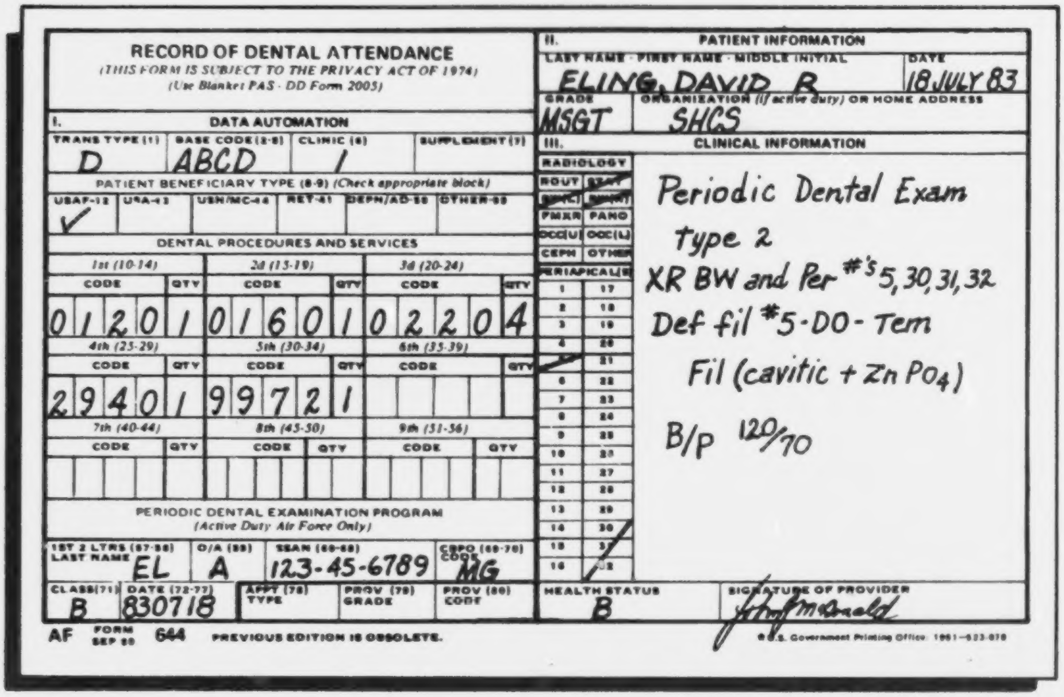
DENTIST'S REMARKS (If necessary, continue on reverse)

Lung Disease - URI - ~~pneumonia~~ pneumonia - 1973 - no dental sig - KS
Reaction to anesthetic - syncope - 1977 KS
BP noted - refered for consult SF513 Int. Med. 10 Jan 83 KS ↔ Consult ret 14 Jan 83 BP normal - suspect anxiety - see attached SF513

SIGNATURE OF DENTIST Kenneth Stoffers, Col, USAF DC	DATE 10 Jan 83

AF FORM AUG 81 696 PREVIOUS EDITION WILL BE USED. ★U.S. GOVERNMENT PRINTING OFFICE 1981 354-141/5580

Figure 1–3. Sample, AF Form 696.



RECORD OF DENTAL ATTENDANCE
(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974)
(Use Blanket PAS - DD Form 2005)

I. DATA AUTOMATION

TRANS TYPE (1)	BASE CODE (2-5)	CLINIC (6)	SUPPLEMENT (7)
D	ABCD	1	

PATIENT BENEFICIARY TYPE (8-9) *(Check appropriate block)*

USAF-12	USA-43	USN/MC-44	RET-41	DEPN/AD-50	OTHER-00
✓					

DENTAL PROCEDURES AND SERVICES

1st (10-14) CODE	QTY	2d (15-19) CODE	QTY	3d (20-24) CODE	QTY
0120	1	0160	1	0220	4

4th (25-29) CODE	QTY	5th (30-34) CODE	QTY	6th (35-39) CODE	QTY
2940	1	9972	1		

7th (40-44) CODE	QTY	8th (45-50) CODE	QTY	9th (51-56) CODE	QTY

PERIODIC DENTAL EXAMINATION PROGRAM
(Active Duty Air Force Only)

1ST 2 LTRS (57-58) LAST NAME	O/A (59)	SSAN (60-68)	CBPO (69-70) CODE
EL	A	123-45-6789	MG

CLASS (71)	DATE (72-77)	APPT (78) TYPE	PROV (79) GRADE	PROV (80) CODE
B	830718			

AF FORM SEP 80 644 PREVIOUS EDITION IS OBSOLETE.

II. PATIENT INFORMATION

LAST NAME - FIRST NAME - MIDDLE INITIAL	DATE
ELING, DAVID R	18 JULY 83

GRADE	ORGANIZATION (If active duty) OR HOME ADDRESS
MSGT	SHCS

III. CLINICAL INFORMATION

RADIOLOGY

ROUT	STAT
[illegible]	[illegible]
PMXR	PANO
OCC(U)	OCC(L)
CEPH	OTHER

PERIAPICAL(S)

1	17
2	18
3	19
4	20
[✓ 5]	21
6	22
7	23
8	24
9	25
10	26
11	27
12	28
13	29
14	[✓ 30]
15	[✓ 31]
16	[✓ 32]

Periodic Dental Exam
Type 2
XR BW and Per #'s 5, 30, 31, 32
Def fil #5-DO-Tem
Fil (cavitic + Zn PO4)
B/P 120/70

HEALTH STATUS: B

SIGNATURE OF PROVIDER: John McDonald

*U.S. Government Printing Office: 1981—523-078

Figure 1-4. Sample, AF Form 644.

only for the purpose of updating the patient's BPLS card. This section is completed for Type 1, 2, or 3 exam and for a class change. Only the first two letters of the last name are required in (57–58). Enter either an "O" for officer or "A" for enlisted in (59). Enter the entire SSAN in (60–68). The CBPO code (69–70) is a two-digit Alpha code. The patient's dental classification is placed in (71) and, of course, the date goes in the date block (72–77). Enter the date of the most recent examination recorded numerically (year, month, and day). Blocks (78), (79), and (80) are left blank.

(2) Section II, Patient Information, must include, typed or printed, the patient's name, military grade only, and organization, custodian of records, or commander.

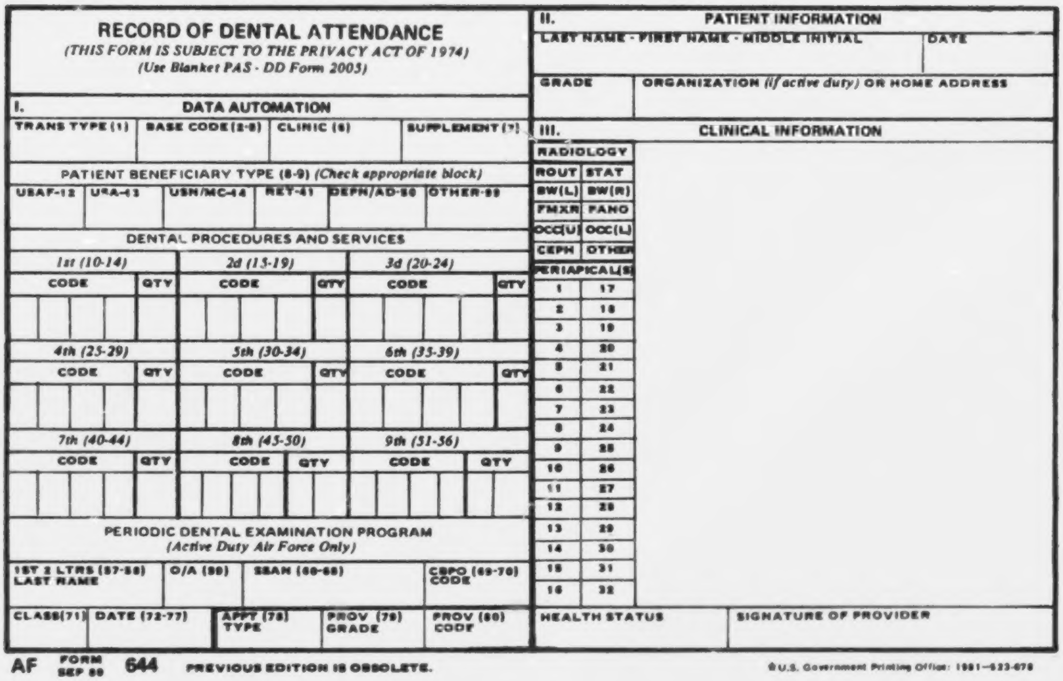
(3) Section III, Clinical Information, includes pertinent information on patient treatment, such as radiology prescriptions. All clinical information to be transcribed to the patient's SF 603 is recorded in the space provided on the AF Form 644. The Health Status for United States Air Force personnel is indicated by dental class (A, B, or C). Enter the latest dental class from the patient's SF 603 or as determined by examination. The health care provider signs the 644 after verification of accuracy and completeness of all information. Print the operator's name above his or her signature, if the SF 603 is not on hand.

Exercises (418):

1. Summarize the two major functions of AF Form 644.

2. Why is it imperative that you properly code and accurately record all entries on AF Form 644?

3. Using the information furnished below, plus the information contained in foldout 7, complete the AF Form 644 shown in figure 1-5.



RECORD OF DENTAL ATTENDANCE
(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974)
(Use Blanket PAS - DD Form 2005)

I. DATA AUTOMATION

TRANS TYPE (1)	BASE CODE (2-5)	CLINIC (6)	SUPPLEMENT (7)

PATIENT BENEFICIARY TYPE (8-9) *(Check appropriate block)*

USAF-12	USA-13	USN/MC-14	RET-41	DEPN/AD-50	OTHER-99

DENTAL PROCEDURES AND SERVICES

1st (10-14)		*2d (15-19)*		*3d (20-24)*	
CODE	QTY	CODE	QTY	CODE	QTY
4th (25-29)		*5th (30-34)*		*6th (35-39)*	
CODE	QTY	CODE	QTY	CODE	QTY
7th (40-44)		*8th (45-50)*		*9th (51-56)*	
CODE	QTY	CODE	QTY	CODE	QTY

PERIODIC DENTAL EXAMINATION PROGRAM
(Active Duty Air Force Only)

1ST 2 LTRS (57-58) LAST NAME	O/A (59)	SSAN (60-68)		CBPO (69-70) CODE
CLASS (71)	DATE (72-77)	APPT (78) TYPE	PROV (79) GRADE	PROV (80) CODE

II. PATIENT INFORMATION

LAST NAME - FIRST NAME - MIDDLE INITIAL	DATE
GRADE	ORGANIZATION *(if active duty)* OR HOME ADDRESS

III. CLINICAL INFORMATION

RADIOLOGY	
ROUT	STAT
BW(L)	BW(R)
FMXR	PANO
OCC(U)	OCC(L)
CEPH	OTHER
PERIAPICAL(S)	
1	17
2	18
3	19
4	20
5	21
6	22
7	23
8	24
9	25
10	26
11	27
12	28
13	29
14	30
15	31
16	32

HEALTH STATUS	SIGNATURE OF PROVIDER

AF FORM SEP 80 644 PREVIOUS EDITION IS OBSOLETE.

☆U.S. Government Printing Office: 1981—523-678

Figure 1-5. AF Form 644 (objective 418, exercise 3).

The date is today's date. The patient is CMSgt Master Sergeant Michael L. T. Goodrich, USAF, SSAN 123-45-6789. Chief Goodrich is assigned to Regional Hospital Sheppard. The location designation of your facility is VNVP, and you are in the base's main dental clinic. A Type 2 examination, including bitewing radiographs, was performed. Chief Goodrich's blood pressure was 120/70. In addition to that examination, a mesio-occlusal carious lesion on the lower left second molar was repaired by placing a base material and an amalgam restoration. Chief Goodrich is in dental classification B. The dentist was Dr. Kenneth Stoffers.

419. Given a series of statements about SF 513, Medical Record—Consultation Sheet, indicate which are true and which are false.

Medical Record—Consultation Sheet. To provide your patients with the best dental care possible, you need a thorough evaluation of their general and oral health. Careful and considerate charting of subsequent diseases requiring treatment is outlined in pencil on SF 603, Health Record—Dental, under item 16 (FO7) or on 603A, under the same item, with brief notes in the Remarks section underneath, when applicable. When a consultation is necessary within the dental service for treatment planning, SF 513, Medical Record—Consultation Sheet, is used (fig. 1-6). Operating instructions in dental clinics may provide an organized system of doing the treatment plan, indicating order of treatment by number. The system must be rational and applicable to all patients, incorporating recommendations of the various dental specialties into a final plan before definitive treatment is instituted. This approach may prevent later changes to the treatment plan. An orderly sequence in treatment planning would be as follows:

(1) Systemic phase. Indicate systemic conditions which require special management of the patient.

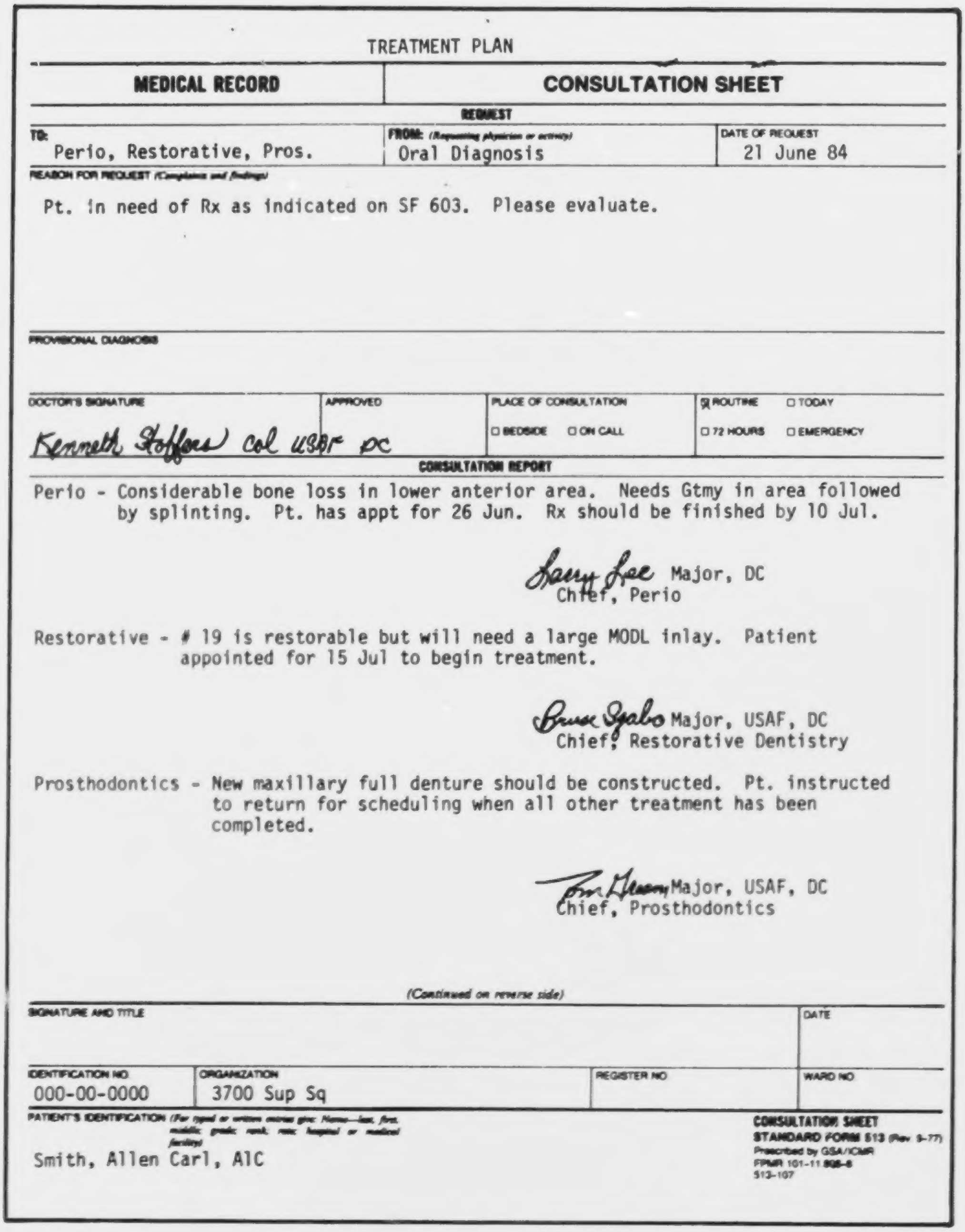
(2) Oral surgery phase. Indicate various oral surgical procedures and identify the teeth to be removed. (Indicate a preoperative dental prophylaxis, if necessary.)

(3) Soft tissue phase. Indicate periodontal therapy for the elimination of gingival inflammation and periodontal pockets and the establishment of physiologic gingival contour.

(4) Functional phase. Indicate occlusal equilibration, restorative dentistry, and fixed and removable prostheses to establish an optimum relationship for the entire dentition (Indicate orthodontic therapy when it is the treatment of choice and is available.)

(5) Maintenance phase. Indicate instructions for preventive dentistry counseling, periodic recall for special evaluation of the patient, and continuous provision of followup treatment, as required.

File treatment plans accomplished on SF 513 in the dental treatment record folder. They may be removed when the proposed treatment has been completed, or they may be modified to reflect current treatment needs.



TREATMENT PLAN

MEDICAL RECORD	CONSULTATION SHEET

REQUEST

TO:	FROM: *(Requesting physician or activity)*	DATE OF REQUEST
Perio, Restorative, Pros.	Oral Diagnosis	21 June 84

REASON FOR REQUEST *(Complaints and findings)*

Pt. in need of Rx as indicated on SF 603. Please evaluate.

PROVISIONAL DIAGNOSIS

DOCTOR'S SIGNATURE	APPROVED	PLACE OF CONSULTATION	
Kenneth Stoffers Col USAF DC		☐ BEDSIDE ☐ ON CALL	☒ ROUTINE ☐ TODAY ☐ 72 HOURS ☐ EMERGENCY

CONSULTATION REPORT

Perio - Considerable bone loss in lower anterior area. Needs Gtmy in area followed by splinting. Pt. has appt for 26 Jun. Rx should be finished by 10 Jul.

Larry Lee Major, DC
Chief, Perio

Restorative - # 19 is restorable but will need a large MODL inlay. Patient appointed for 15 Jul to begin treatment.

Bruce Szabo Major, USAF, DC
Chief, Restorative Dentistry

Prosthodontics - New maxillary full denture should be constructed. Pt. instructed to return for scheduling when all other treatment has been completed.

Major, USAF, DC
Chief, Prosthodontics

(Continued on reverse side)

SIGNATURE AND TITLE			DATE
IDENTIFICATION NO	**ORGANIZATION**	**REGISTER NO**	**WARD NO**
000-00-0000	3700 Sup Sq		

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name—last, first, middle; grade; rank; rate; hospital or medical facility)*

Smith, Allen Carl, A1C

CONSULTATION SHEET
STANDARD FORM 513 (Rev. 9-77)
Prescribed by GSA/ICMR
FPMR 101-11.806-8
513-107

Figure 1–6. Sample, SF 513, Medical Record.

To obtain medical consultation, the attending dental officer determines the consultation, clinical, laboratory, and similar services. The dental officer then initiates SF 513 in duplicating, giving all pertinent information, including any laboratory or X-ray findings. The dental office may discuss the case with the consultant or bring the patient to the consultant. Only the SF 513, which is returned by the consultant as part of the patient's dental health record, is retained until it is of no further value.

To request a dental consultation, a medical officer uses a SF 513. The dental consultant should complete the examination as expeditiously as possible. No treatment should be given unless it is authorized by the medical officer who requested the consultation. If treatment is to be given, a determination of special considerations should be made before the treatment begins. If the requesting officer has hot provided enough information, contact that person. In answering a consultation from a medical officer, remember that he or she probably is not interested in anything but general information. Do not name specific teeth or surfaces of teeth, unless this is pertinent to the case. You should avoid the use of dental abbreviations which may be unfamiliar to the medical officer.

Exercises (419):

Identify the following statements as true or false by entering a T or an F in the blanks provided. Explain any false statements.

_____1. A Medical Record—Consultation Sheet should be used when a consultation is necessary for treatment planning within Dental Services.

_____2. The organized system of accomplishing the treatment plan needs no operating instructions and need not be finalized before definitive treatment is instituted.

_____3. In an orderly sequence of treatment planning, the maintenance phase should be placed before the soft tissue phase.

_____4. Treatment plans prepared on SF 513 should be filed in the dental treatment record folder. They may be removed when the proposed treatment has been completed, or they may be modified to reflect current treatment needs.

_____5. To obtain medical consultation, the attending dental officer determines the services needed, makes arrangements to obtain these services, initiates SF 513 in duplicate, and files the copy returned by the consultant.

_____6. A dental officer should answer a consultation from a medical officer requested on SF 513 in great detail and should use dental abbreviations.

420. Specify procedures for using on AF Form 935 as a tool for diagnosing gingival and periodontal disease.

Periodontal Diagnosis and Treatment Plan. All Air Force dental facilities provide clinical periodontic services. To make sure that periodontal problems are diagnosed and treated at an early stage, the periodontal status of all patients should be evaluated. Particular attention should be given to gingival health, bleeding, pocket depth, and irritants responsible for gingival or periodontal abnormalities. Evaluation should be comprehensive, including such factors as diet, habits, and systemic conditions. Use should be made of clinical laboratory studies and other diagnostic aids available. The patient should be counseled concerning measures necessary to prevent or control periodontal disease.

AF Form 935, Periodontal Diagnosis and Treatment Plan, provides a basic periodontal examination, diagnosis and treatment planning record for periodontal therapy. This form provides a record of the patient's periodontal status before, during, and after active periodontal therapy. AF Form 935 becomes a permanent part of the patient's dental record. Appropriate enties must also be made on the patient's SF 603.

Precise instructions for accurate completion of AF Form 935 are found in AFR 162-1. Charting must be precise, accurate, and neat to be meaningful. The patient's name, social security number, date of form completion, significant medical history, and blood pressure (with date taken) should be recorded in ink. All other notations are made in red, blue, and regular pencil.

Exercises (420):

1. What is the basic purpose of AF Form 935?

2. How long is AF Form 935 retained in the patient's dental record?

304

3. What type of information about the patient's periodontal health is recorded on AF Form 935?

4. Where can precise instructions be found for the accurate completion of AF Form 935?

421. Given statements concerning the forms used to request medical laboratory and radiographic services, indicate which are true and which are false.

Laboratory Requests. Laboratory tests and examinations are requested on one of the specific laboratory forms; for example, SF 550, Urinalysis; SF 549, Hematology; or SF 551, Serology. SF 515, Medical Record—Tissue Examination, must be prepared in detail for tissues submitted for microscopic analysis. A brief pertinent history on SF 515 must be included. The completion and routing of the laboratory requests and SF 515 should be in accordance with the local hospital instructions.

Radiographic Requests. Request X-ray examinations, other than dental X-ray services, on SF 519A, Radiographic Report. All needed information should be included so that the X-ray section may provide the desired services. Local instructions on appointments and time schedules must be observed.

Exercises (421):

Identify the following statements as true or false by inserting T or F in the blanks provided. Explain any false answers.

_____ 1. SF 515, Tissue Examination, must be prepared in detail for tissues submitted for microscopic analysis, and it is essential that a brief pertinent history be included.

_____ 2. SF 519A, Radiographic Report, is used to request dental X-ray examinations.

1-5. Miscellaneous Forms

In addition to the forms already mentioned, you are quite likely to encounter some others. Although the dental officer is directly responsible for the entries on different records, it is your duty to accurately record the entires onto the record. Let's look at these additional forms and see why they are needed and what purpose they serve.

422. Identify forms used to record expenditures of security items.

Forms Involving Security Items. Some of the items Dental Services use require close security. Such items are dental gold, platinum, ethyl alcohol, and narcotics. When these items are used, they have to be accounted for by completing one of the following forms:

AF Form 994, Dental Laboratory Prescription and Consultation Request. When a restoration is needed, the dentist uses AF Form 994, Dental Laboratory Prescription and Consultation Request, to give the laboratory a detailed prescription. In so doing, the dentist must take care to fill out the form completely and accurately. An incomplete prescription may result in an unsatisfactory restoration. Be sure that the laboratory is advised, in writing, exactly what materials to use and the services to provide.

Keep in mind that laboratories at the base dental clinics may be very limited in their ability to provide support. They may be little more than shipping rooms. In this case, they will be able to do little more than pour the impressions; package the master cast, the jaw relations, and the AF Form 994; and send the case to the area dental laboratory for fabrication. On the other hand, the base dental laboratories may be able to provide almost all of the laboratory support required. The area laboratory may be called on to provide complete laboratory service or other fabrication of chrome-cobalt castings.

The laboratory data section of AF Form 994 is for the use of the dental laboratory, and no entries may be made by the officer submitting the case. The checklist is for the use of the laboratory and is used to indicate the completion of each step in the fabrication of a case. The quantity of each type of previous metal used for the case is entered, and the AF Form 994 serves as part of the record of precious metal expenditures.

AF Form 520, Record of Dental Precious Metals and Alloys. A record of the expenditure of precious metals must be kept. The base dental surgeon is responsible for the procurement, safekeeping, and maintenance of records, and authorization for expenditure of the materials. A Dental Laboratory Prescription and Consultation Request, AF Form 994, is completed for each person on whom this material has been expended. When signed by the officer responsible for the account and numbered consecutively, the AF Forms 994 become proper vouchers for dropping the material from the Record of Dental Precious Metals and Alloys, AF Form 520. AF Form 520 is a record of precious metals received and expended by Dental Services. It is also a record of the inspection and verification of these materials. You should be constantly aware of the importance of accurately accounting for precious metals, although your duty may be limited to preparing the request for issue.

AF Form 579, Controlled Substances Register. There are occasions when it is necessary to have alcohols, narcotics, or barbiturates available in the dental clinic. The drugs are security items, and each clinic may keep a limited stock of them.

The base dental surgeon or a designated representative is responsible for the procurement, safekeeping, and dispensing of the drugs maintained in the dental clinic. Each drug transaction must be recorded on AF Form 579, Controlled Substances Register. This register shows the receipt, issue, and balance of each drug. These security items must be kept under lock when they are stored.

AF Form 781, Multiple Item Prescription. A prescription is a written order to a pharmacist instructing the pharmacist to dispense a specific medication to a patient. AF Form 781 is the prescription form used by Air Force dentists, physicians, and veterinarians. When properly completed, the actual prescription portion of the form (Rx) indicates the name of the medication, the quantity, and the instructions for administrations. The form must be signed by a medical, dental, or veterinary officer.

Exercises (422):

1. Match each function listed in column A with the miscellaneous form listed in column B by inserting the appropriate letter.

Column A

______(1) A written order to a pharmacist that indicates the name of medication, the quality, and the instructions for its administration; it must be signed by a medical, dental, or veterinary office.

______(2) The drugs listed here are security items, and each clinic is authorized to maintain a limited stock of them.

______(3) This register shows the receipt, issue, and balance of each drug and each item must be kept under lock when stored.

______(4) This form is a detailed prescription furnished the laboratory that insures the construction of a restoration that meets the patient's requirement.

Column B

a. AF Form 994, Dental Laboratory Prescription and Consultation Request.
b. AF Form 520, Record of Dental Precious Metals and Alloys.
c. AF Form 781, Multiple Item Prescription.
d. AF Form 579, Controlled Substances Register.

Column A *Column B*

______(5) The laboratory data section of this form is used by the dental laboratory; the officer submitting the case makes no entries there.

______(6) The materials accounted for on this form are dropped when accounted for on vouchers (properly numbered and signed AF Forms 994). The form serves as a record of inspection, verification, and accounting for precious metals.

423. Identify two forms initiated by a hospital which may concern dental treatment, and state why close coordination is needed between the wards and the dental clinic in connection with SF 521.

Hospital Forms Concerning Dental Conditions. You will probably have contact with some forms initiated by the hospital—namely, SF 88, Report of Medical Examination, and SF 521, Clinical Record— Dental.

Report of Medical Examination. Frequently, you will have patients needing a dental examination in conjunction with a medical physical. Standard Form 88, Report of Medical Examination, is used to record the findings of the dental examination. Use the charting symbols described on the form for its completion. The type of dental examination required is determined by the purpose of the medical physical, which will already have been noted on the SF 88 initiated by the hospital. Although this form is self-explanatory and quite simple to complete, it is important that the entries you make are neat and accurate in every detail.

Clinical Record—Dental. The Standard Form 521, Clinical Record—Dental, is used by Dental Services for hospitalized patients, regardless of whether they are your dental patients or are from another medical section. This record is a part of the hospital records kept for the patient and are not a part of his or her dental health record. However, dental treatment recorded on SF 521 for a hospitalized patient should be summarized, and the summary should be entered on the dental health record. The SF 521 is initiated by the medical officer or ward nurse, and it will accompany the patient on each visit to the dental service.

The examining dental officer will perform an oral examination of the referred patient, the results of which are entered on SF 521. The numbered tooth chart is used to graphically indicate the presence of restorable carious teeth, teeth to be extracted, the absence of natural teeth, and the presence of periodontal conditions. Other entries indicate the type of radiographs taken, the presence or absence of periodontoclasia and the degree of severity, the degree of calculus present, the presence of gingival pathology, dentures required, abnormalities of occlusion, dental classification, type of dental examination performed, recommendations concerning treatment, and the approximate time required for the recommended treatment. Coordination between the wards and the dental clinic is necessary in connection with SF 521 so that any dental care provided does not interfere with the patient's medical treatment.

Exercises (423):

1. What two forms initiated by the hospital may also concern dental treatments?

2. How is the type of necessary dental examination determined for a patient who needs a dental examination in conjunction with a medical physical?

3. Is an SF 521, Clinical Record—Dental, considered a part of a patient's dental health record when it is initiated by the medical officer and is accompanying a hospitalized patient on a visit to Dental Services? Explain your answer.

4. Why is close coordination necessary between the wards and the dental clinic in connection with an SF 521?

1-6. Dental Reports

The various dental reports provide dental service statistical data and other current information for dental activities at all levels of command. The information these reports provide is used to evaluate trends and to forecast requirements about professional care, manpower, equipment, facilities, and expense accounting. We will briefly cover the reports you may be exposed to, their preparation, and when they are submitted.

424. State the procedures involved, the data included, and information about submission in connection with the various parts of the Dental Services and Activities Report 7104.

Dental Services and Activities Report 7104. This report provides information on dental activities at all levels of command to include professional care, manpower, equipment, facilities and individual research, academic education, and internal dental education programs. The report is used as a management tool at each level to:

(1) Keep the Dental Services strength at the proper level.

(2) Evaluate the effect of, or the need for, improvements in the organization, procedures, methods, equipment, training, and professional education in the clinic.

(3) Support current personnel staffing.

(4) Forecast requirements pertaining to professional care, manpower, equipment, facilities, and training.

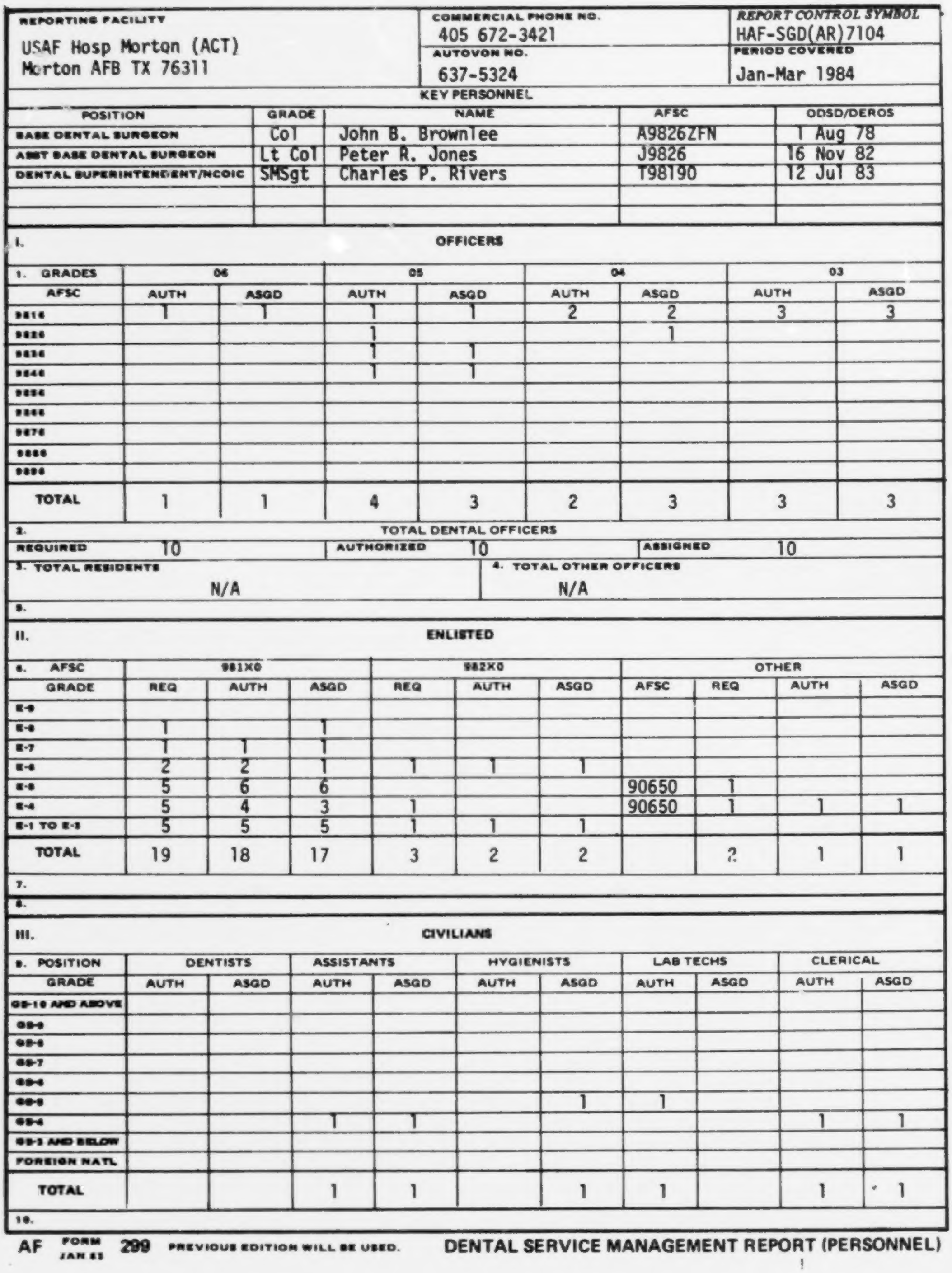
The Dental Services and Activities Report also provides factual and timely workload, resource, and activity data to all levels. It is an aid to effective management of dental services and operation. This report furnishes dental managers with data to insure clinics have adequate resources to do the mission and it allows participants to communicate concerns, requirements, and impressions to appropriate levels.

Summary of Parts of Information Requirement. The Dental Services and Activities Report is divided into six parts. We will cover five of these parts; part 3, not covered, is reserved for future use.

Part 1, Base and Command Dental Service Reporting System. This dental service report contains the total dental procedures and services provided to patients by dental health care providers. The input data is specifically or dental-medical related and shows the full health care delivery of a dental activity. Dental managers can use the output and the information for budgeting and operations planning.

Preparation and submission procedures for part 1 of the 7104 report are contained in AFM 162-693, *Command Dental Service Reporting (BDSR) System.* Part 1 is submitted monthly.

Part 2, Dental Service Management Report (Personnel). This part of the 7104 report summarizes the professional capabilities, availability and management of dental personnel resources. AF Form 299, Dental Service Management Report (Personnel), is used to submit part 2 of the 7104 report. See figures 1-7A, and 1-7B. AF Form 299 is submitted for a 3 month period ending on the last day of December, March, June, and September. This report is submitted by the Director, Dental Services/Base Dental Surgeon. The 299 identifies all key personnel, officers, enlisted and civilians assigned to the clinic. It also lists laboratory technicians with special experience identifiers, the number of cases mailed to area dental laboratorys, Red Cross volunteer mandays, and time utilization of military and civilian employees. Total duty days for the current reporting period are recorded and a section for remarks is provided.



REPORTING FACILITY USAF Hosp Morton (ACT) Morton AFB TX 76311	COMMERCIAL PHONE NO. 405 672-3421	*REPORT CONTROL SYMBOL* HAF-SGD(AR)7104
	AUTOVON NO. 637-5324	PERIOD COVERED Jan-Mar 1984

KEY PERSONNEL

POSITION	GRADE	NAME	AFSC	ODSD/DEROS
BASE DENTAL SURGEON	Col	John B. Brownlee	A9826ZFN	1 Aug 78
ASST BASE DENTAL SURGEON	Lt Col	Peter R. Jones	J9826	16 Nov 82
DENTAL SUPERINTENDENT/NCOIC	SMSgt	Charles P. Rivers	T98190	12 Jul 83

I. OFFICERS

1. GRADES	06		05		04		03	
AFSC	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD
9816	1	1	1	1	2	2	3	3
9826			1			1		
9836			1	1				
9846			1	1				
9856								
9866								
9876								
9886								
9896								
TOTAL	1	1	4	3	2	3	3	3

2. TOTAL DENTAL OFFICERS

REQUIRED 10	AUTHORIZED 10	ASSIGNED 10

3. TOTAL RESIDENTS N/A	4. TOTAL OTHER OFFICERS N/A

5.

II. ENLISTED

6. AFSC	981X0			982X0			OTHER			
GRADE	REQ	AUTH	ASGD	REQ	AUTH	ASGD	AFSC	REQ	AUTH	ASGD
E-9										
E-8	1		1							
E-7	1	1	1							
E-6	2	2	1	1	1	1				
E-5	5	6	6				90650	1		
E-4	5	4	3	1			90650	1	1	1
E-1 TO E-3	5	5	5	1	1	1				
TOTAL	19	18	17	3	2	2		2	1	1

7.

8.

III. CIVILIANS

9. POSITION	DENTISTS		ASSISTANTS		HYGIENISTS		LAB TECHS		CLERICAL	
GRADE	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD	AUTH	ASGD
GS-10 AND ABOVE										
GS-9										
GS-8										
GS-7										
GS-6										
GS-5						1	1			
GS-4			1	1					1	1
GS-3 AND BELOW										
FOREIGN NATL										
TOTAL			1	1		1	1		1	1

10.

AF FORM JAN 83 299 PREVIOUS EDITION WILL BE USED. **DENTAL SERVICE MANAGEMENT REPORT (PERSONNEL)**

Figure 1-7A. Sample, AF Form 299 (front).

IV. OTHER DATA

11. LABORATORY TECHNICIANS WITH SPECIAL EXPERIENCE IDENTIFIERS (SEIS)
(Continue in Remarks if more space is needed.)

GRADE	NAME	482	% UTIL	483	% UTIL	484	% UTIL		
TSgt	Armando, Samuel			X	20	X	60		

12. NUMBER OF CASES MAILED TO AREA DENTAL LABORATORY

FIXED UNITS 97	REMOVABLE ARCHES 40
13. RED CROSS VOLUNTEER MANDAYS 5	14. TOTAL NUMBER OF ACTIVE RED CROSS VOLUNTEERS 1

15. TIME UTILIZATION – MILITARY AND CIVILIAN EMPLOYEES

MANDAYS	OFFICERS	ENLISTED	CIVILIAN
TOTAL AVAILABLE	620	1215	186
PREVENTIVE DENTISTRY	1.5	155	
TRAINING	30	30	1
OTHER	3	44	

TOTAL DUTY DAYS THIS REPORTING PERIOD 66

16. READINESS TRAINING: PHASE 1 PHASE 2 PHASE 3

17.

18.

19.

20.

21.

22.

23.

24.

V. REMARKS *(Continue on plain sheet of paper if more space is needed. Identify reporting facility and items.)*

1. SMSgt Charles P. Rivers, 98190 assigned full time duty as medical first sergeant, 1-31 January 1984.

TYPED OR PRINTED NAME AND GRADE	SIGNATURE	DATE
JOHN B. BROWNLEE, Col, USAF DC	John B. Brownlee	1 Apr 84

Figure 1-7B. Sample, AF Form 299 (back).

Part 4, Reporting of Special Dental Activities—Research. This part of the 7104 report provides general information on dental research activities. It does not replace the function of the individual project reports required by other directives. It supplements those reports and provides current information for coordinating management improvement, budgetary guidance, and research programming. Part 4 of the 7104 report is prepared by dental officers engaged in clinical research under the provision of AFR 169–6, *Clinical Investigation and Human Test Subjects in the Medical Service*. Personnel responsible for submitting this report should collect documentation of activity during the reporting period to help in preparing the report. This report will normally cover 1 calendar quarter and be submitted no later than the 5th day following the period covered in the report.

Part 5, Report of Special Dental Activities—Academic. This part of the 7104 report provides information that will help determine future course requirements. Educational enhancement of dental personnel through a continuing program of the highest quality is the goal. It supplements other reports and provides essential data to justify future programs.

Part 5 of the 7104 report is submitted by all dental personnel on extended active duty who attend a training course in a civilian or military institution that required TDY orders. This report normally covers the entire period of the course and is submitted within 30 days after completion of the course.

Part 6, Report of Special Dental Activities—Teaching. This part of the 7104 report provides information requirements. The class rosters helps managers track academic reports and utilization of attendees.

Part 6 of the 7104 report is submitted by the dental officer/responsible for the dental AFM 50–5, *USAF Formal Schools Catalog*. This applies only to educational programs at approved Air Force teaching facilities. This report normally covers the entire course length. For long courses, submit quarterly. Submit the teaching report within 5 days following a calendar quarter during which teaching was performed. For short courses crossing quarterly limits, submit within 5 days of course completion.

Exercises (424):

1. Briefly explain how the Dental Services and Activities Report 7104 is used as a management tool.

2. Give a brief summary of each part of the Dental Services and Activities Report—7104.
   a. Part 1.

   b. Part 2.

   c. Part 4.

   d. Part 5.

   e. Part 6.

425. State the function that the budget performs and point out the equipment information required for its planning.

Financial Plans and Budgets. Your participation in budget planning will vary from clinic to clinic; but no matter who writes the final document, the base dental surgeon needs support from the entire clinic while the budget is being formulated. The submission of a budget is not a procedure that can be performed in a few hours. The budget sets the final pattern for the financial operation of the clinic for an entire year.

To plan and program for your dollar requirements, all aspects of your operation must be known. Stock levels must be established for supplies, and the age and condition of equipment must be known to decide if a replacement or new item is to be requested. You can get most of the information you need from the MEMO officer. If the MEMO officer doesn't have the current files needed, he or she will do whatever necessary to get the data you need. The medical supply officer may also assist you in preparing the justification necessary for all equipment requests.

The final step, when formulating a budget, is to make a summary of the procedures performed for the past several years. The hospital financial office has copies of the dental service's Medical Expense Report, RCS: HAF–SGD(Q) 7104, on file and can furnish you with the cost per procedure for both the clinic and the laboratory.

Exercises (425):

1. What function does the budget serve for a clinic?

2. What equipment information is needed when planning a budget? Why?

3. What report can furnish you with the cost per procedure for both the clinic and laboratory?

426. State the main objective of the Air Force Historical Program, identify the office that provides guidance to the major commands concerning historical reports for medical units, and specify information the medical unit historian should emphasize.

Air Force Historical Program. The main objective of the Air Force Historical Program is to publish objective, comprehensive, and accurate accounts of Air Force activities. Specifically, these publications:

a. Provide historical data as a guide for Air Force planning, operations, training, and educational purposes.

b. Preserve and disseminate the history of the Air Force and its predecessor organizations.

c. Contribute to the understanding of the role of airpower.

Under the policy guidance and direction of the Office of the Surgeon General, major commands assign qualified medical service personnel to prepare annual historical reports for medical units. These histories of medical administrative and professional activities should give primary emphasis to significant developments in military medicine and their contributions to operational effectiveness.

All units having a regularly established medical service must submit an annual narrative report in accordance with appropriate directives. Each major command surgeon prescribes the procedures for obtaining and forwarding these histories to the Office of the Surgeon General, USAF. These narrative reports should cover planning, operational, supporting, and administrative activities, and should note particularly the degree of success in these areas and the problems and difficulties encountered. The history should provide specific information concerning organization and deployment. It should include changes in personnel strength, facilities and equipment, and budgetary and fiscal matters. The dental service history is incorporated with that of the medical unit. The combined unit history is then forwarded to the appropriate headquarters.

Exercises (426):

1. What is the main objective of the Air Force Historical Program?

2. Who provides the policy guidance and direction to the major commands concerning historical reports for medical units?

3. When preparing historical reports, what should a medical unit's historian emphasize?

4. What is done with the Dental Services' history before it is submitted to higher headquarters?

1-7. Programs

There are a number of programs of concern to Dental Services. We will cover these programs to different degrees, depending on how involved you are likely to be with them. Where we give a brief coverage only, we have listed the AF regulation or manual where you can get additional information.

427. Identify various dental service programs.

Hypertension Screening. Hypertension has significant impact on the health and welfare of the Air Force. The Dental Services support the medical objectives of early detection, evaluation, and treatment of hypertension.

Hypertension screening of active duty Air Force personnel is an essential part of any dental examinations. The patient's blood pressure reading and date are entered on AF Form 696. When a patient's blood pressure is abnormal, send the patient to the proper medical clinic, with a SF 513, Medical Record—Consultation Sheet, or other approved forms, for further evaluation, and record the abnormal pressure in Item 17, SF 603, 603A with the statement "patient has been referred for further evaluation." When the consultation is returned, record the findings in Item 17 of SF 603 or 603A in the remarks section of AF Form 696. It is a good idea to keep a suspense file of consultation requests. This will aid you in making sure that they are returned and properly recorded. The multiple entry capability of AF Form 696 lets you record multiple readings during the same course of treatment.

Dental Quality Assurance and Risk Management Programs. Military dentistry requires a unique approach to dental services. Health care providers address the unusual demands placed upon the military patient. Remote assignments, extreme stress, and unexpected travel are a few examples. Quality assurance programs are a sound the Air Force Dental Service accomplishes its portion of the total health care mission. AFR 168-13, *Risk Management In Medical Care Delivery*, and AFR 168-4, *Administration of Medical Activities*, explains the general structure of risk management, informed consent, and credentialing and how these programs compliment each other.

Dental quality assurance. The base dental surgeon or director of Base Dental Services is a member of the medical treatment facility Executive and Risk Management Committee, and, as such, is responsible for the quality of dental services. The concerted efforts of all members and committees is to insure that each patient receives the best care possible at each treatment facility. Quality assurance is the work ethic of the health care provider.

Risk management. This is a program designed to identify, contain, reduce or eliminate the potential for harm to patients, visitors, and employees, and the potential financial loss to the facility if a compensable event occurs. Risk management is usually concerned with the delivery system or site rather than the practitioner's performance. The base dental surgeon participates as a member of the Risk Management Committee commensurate with other executive responsibilities in the medical treatment facility. Areas of concern identified by Dental Service are addressed through this committee in accordance with AFR 168-13.

Committee function. The Quality Assurance and Risk Management Committe meets at least monthly. They evaluate credential folders, review training folders, perform retrospective dental records audits, and periodically review operating instructions.

The patient's dental health record is the primary source of treatment information. It must be accurate, complete, and describe the patient's status prior to treatment. The care provided, progress (if indicated) and condition when the patient was dismissed is also noted. To provide an unbiased measure of patient care, the number of dental records used in the evaluation study should be a representative sample of the care of all providers. Constant validation of data from records will improve the reliability of the recording methodology.

Personnel Reliability Program. The Personnel Reliability Program (PRP) is designed to make sure that each person who performs duties with nuclear weapons or systems, and certain other high-risk functions, meet the required standards of individual reliability. Dental records are included under requirements outlined in AFR 35-99, *Personnel Reliability Program*. The base dental surgeon advises dental personnel of their responsibilities in the PRP. AF Form 745, Personnel Reliability Program Record Identifier, when applicable, must be prominent and precede all other documents in the dental health record.

Air Force Cancer Program. The Air Force Cancer Program is a multidisciplined approach to diagnose, treat, and manage tumor patients for which Dental Services has a shared responsibility. Procedures for this program are in AFR 160-64, *Air Force Cancer Program*.

Exercises (427):

1. Match the programs listed in column A with its correct description listed in column B.

Column A	*Column B*
______(1) Personnel Reliability Program.	a. This program is covered by AFRs 168-13 and 168-4, and has a committe which meets at least monthly. They evaluate credential folders, review training folders, perform retrospective dental records audits, and periodically review operating instruction.
______(2) Hypertension Screnning Program.	b. Procedures for this program are outlined in AFR 160-64. It is a multidisciplined approach to diagnose, treat, and manage tumor patients for which Dental Service has a shared responsibility.
______(3) Air Force Cancer Program.	c. This program is designed to make sure that each person who performs duties with nuclear weapons or systems, and certain other high-risk functions meet the required standards outlined in AFR 35-99.
______(4) Dental Quality Assurance and Risk Management Program.	d. This program is a screening program conducted on active duty Air Force personnel in conjunction with periodic dental examinations.

Publications and Dental Supply

THIS CHAPTER deals with publications and dental supply. Both are very important to your job. You need publications for directive purpose and supplies to provide patient care.

Our discussion begins with publications, which is limited to the use of Air Force indexes. You need to make good use of these indexes, because they can save you considerable time when looking for a particular publication.

2-1. Indexes to Air Force Publications

When you have a lot of publications, you need an index to help you find specific information. Regular libraries use a card index. The American Dental Association, with the cooperation of the National Library of Medicine, publishes the "Index to Dental Literature." Published quarterly, it provides an excellent way to find sources on dental topics. The Air Force has indexes published as regulations.

428. Identify the two most used numerical indexes, and specify how to use Air Force indexes.

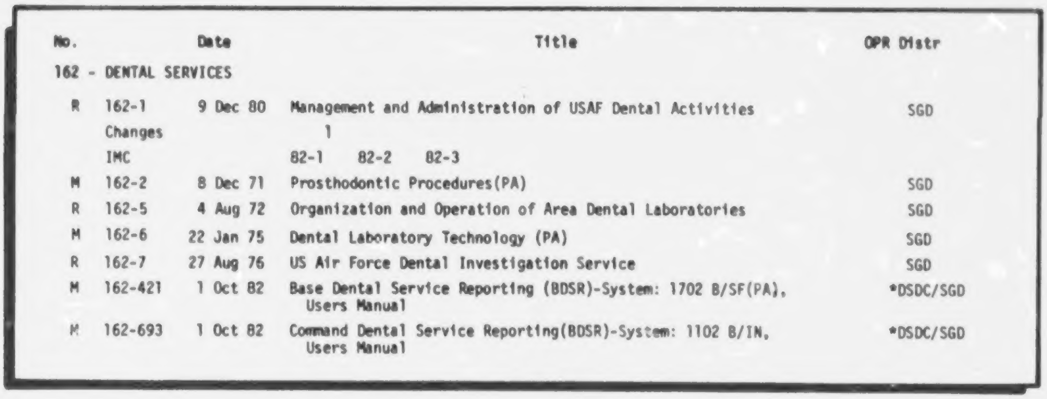
AFR 0–2, *Numerical Index of Standard and Recurring Air Force Publications.* This regulation lists departmental publications in numerical order according to subject, series, type, and status of the publication. It is divided into several sections. Recurring periodicals and current visual aids are listed in the first two sections. These are followed by the major section of the regulation, which lists current regulations, manuals, and pamphlets; it begins with those publications in the "0" subject series (indexes) and continues through the "900" subject series (awards, ceremonies, and honors). The final section lists those regulations, manuals, pamphlets, visual aids, and recurring periodicals that have become obsolete since the last publication of AFR 0–2.

In AFR 0–2, distribution symbols tell which organizations are authorized publications. An Air Force hospital that has a need for them can get publications having a B, S, F, or X distribution symbol. The information in AFR 0–2 is listed in columnar form (see fig. 2-1). The symbols (R and M) tell the type of standard publication (regulations and manuals) in the "No" column. The "–1" in "R 162–1" is a control number—meaning that this is the first departmental regulation issued for this subject series. Use the latest edition of this index to be sure your publications are current and to locate publications that you need. If you need to see a publication that is not in your office files, there is a good chance that you can find it in the Master Publications Reference Library.

AFR 0–9, *Numerical Index of Departmental Forms.* As its name implies, this index concerns the forms used by the various governmental agencies. AFR 0–9 furnishes valuable information concerning the currency, the packaging, the reproduction, and the directives that govern the use and completion of each form. AFR 0–9 is divided into seven sections, or chapters: Section A, Departmental Forms; Section B, Classified Forms; Section C, Accountable Forms; Section D, Forms Requiring Storage Safeguards; Section E, Forms Requisitioned Quarterly; Section F, Forms Covered by a Blanket Privacy Act; and Section G, Obsolete Forms. Of these seven sections, Sections A and G are the most important to our operation. Section A in AFR 0–9 is titled "Departmental Forms;" it lists forms from several different agencies. Of those forms listed, you are most interested in Air Force (AF) forms, Department of Defense (DD) forms, and Standard Forms (SFs).

The listing of the forms is in a columnar format (see fig. 2-2). The column titled "Number" gives the form number. The "Date" column gives the date of the current version of the form. The "Unit of Rqn" column gives the unit you use to requisition the form. Each unit is designated by a two-letter code. You can find these codes explained, beginning on the title page of AFR 0–9. The "Title" column, of course, gives the title of the form. Certain forms may have the entry "LRA" in the Title column. This means that local reproduction of that form is authorized. The "Const/Pkg" column shows the construction of the form (cutsheet, pad, card, etc.). The abbreviations that apply to the Unit of Rqn are also used in this column. The final column, Prescribing Directive, lists the directive that prescribes the use and completion of each form. As you can see, the information about manuals and regulations we have covered and the forms used by the Air Force are closely related. A display dot (·) appearing in any of the columns indicates changed information or that a new form was issued since the latest edition of the index.

Section G of AFR 0–9 lists the forms that have become obsolete since the last AFR 0–9 was published. The "Disposition" column of Section G tells you whether to continue using the obsolete forms or to salvage them (reclaim as waste paper). "Use" in this section of AFR 0–9 means that you continue use of the obsolete supply of existing forms on hand (including those in the publications distribution system) until the supply is gone.



	No.	Date	Title	OPR Distr
162 - DENTAL SERVICES				
R	162-1	9 Dec 80	Management and Administration of USAF Dental Activities	SGD
	Changes		1	
	IMC		82-1 82-2 82-3	
M	162-2	8 Dec 71	Prosthodontic Procedures(PA)	SGD
R	162-5	4 Aug 72	Organization and Operation of Area Dental Laboratories	SGD
M	162-6	22 Jan 75	Dental Laboratory Technology (PA)	SGD
R	162-7	27 Aug 76	US Air Force Dental Investigation Service	SGD
M	162-421	1 Oct 82	Base Dental Service Reporting (BDSR)-System: 1702 B/SF(PA), Users Manual	*DSDC/SGD
M	162-693	1 Oct 82	Command Dental Service Reporting(BDSR)-System: 1102 B/IN, Users Manual	*DSDC/SGD

Figure 2-1. AFR 0-2.

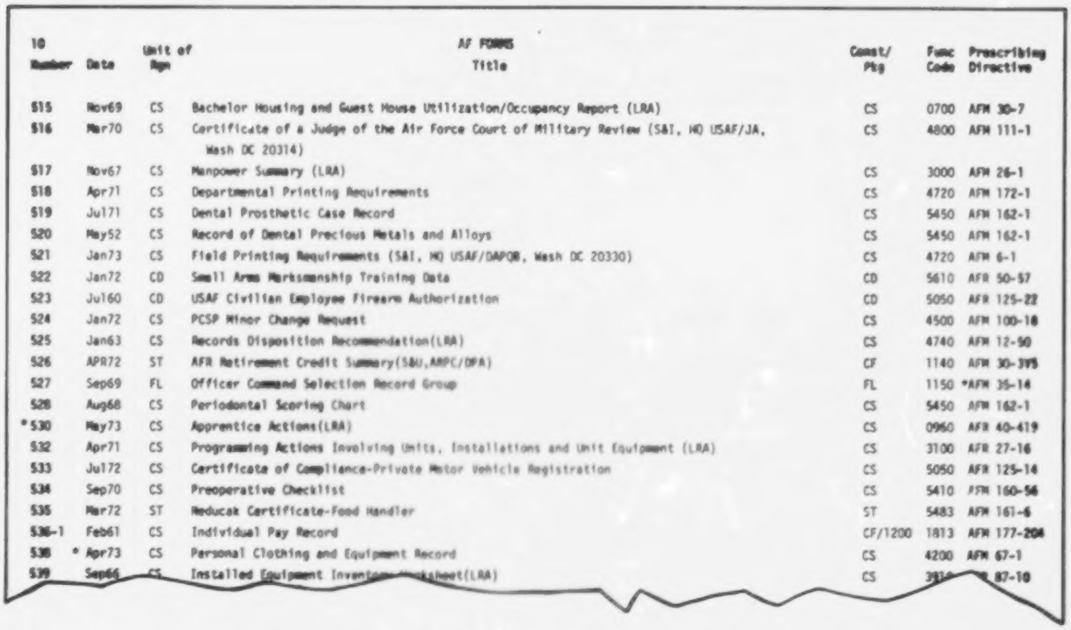
Exercises (428):

1. Match the title in column A with the index in column B.

Column A	*Column B*
______(1) *Numerical Index of Standard and Recurring Air Force Publications.*	a. AFR 0-2.
______(2) *Numerical Index of Departmental Forms.*	b. AFR 0-9.

2. You have been asked to find out the title and date of a current visual aid concerning mouth-to-mouth resuscitation. The visual aid should be one that is available through distribution channels from the AF Publications Distribution Center. Where should you look for the information you need?

3. What type of publication is AFR 162-1?



ID Number	Date	Unit of Agn	AF FORMS Title	Const/ Pkg	Func Code	Prescribing Directive
515	Nov69	CS	Bachelor Housing and Guest House Utilization/Occupancy Report (LRA)	CS	0700	AFM 30-7
516	Mar70	CS	Certificate of a Judge of the Air Force Court of Military Review (S&I, HQ USAF/JA, Wash DC 20314)	CS	4800	AFM 111-1
517	Nov67	CS	Manpower Summary (LRA)	CS	3000	AFM 26-1
518	Apr71	CS	Departmental Printing Requirements	CS	4720	AFM 172-1
519	Jul71	CS	Dental Prosthetic Case Record	CS	5450	AFM 162-1
520	May52	CS	Record of Dental Precious Metals and Alloys	CS	5450	AFM 162-1
521	Jan73	CS	Field Printing Requirements (S&I, HQ USAF/DAPOB, Wash DC 20330)	CS	4720	AFM 6-1
522	Jan72	CD	Small Arms Marksmanship Training Data	CD	5610	AFR 50-57
523	Jul60	CD	USAF Civilian Employee Firearm Authorization	CD	5050	AFR 125-22
524	Jan72	CS	PCSP Minor Change Request	CS	4500	AFM 100-18
525	Jan63	CS	Records Disposition Recommendation(LRA)	CS	4740	AFM 12-50
526	APR72	ST	AFR Retirement Credit Summary(S&U,ARPC/DFA)	CF	1140	AFM 30-3V5
527	Sep69	FL	Officer Command Selection Record Group	FL	1150	*AFM 35-14
528	Aug68	CS	Periodontal Scoring Chart	CS	5450	AFM 162-1
*530	May73	CS	Apprentice Actions(LRA)	CS	0960	AFR 40-419
532	Apr71	CS	Programming Actions Involving Units, Installations and Unit Equipment (LRA)	CS	3100	AFR 27-16
533	Jul72	CS	Certificate of Compliance-Private Motor Vehicle Registration	CS	5050	AFR 125-14
534	Sep70	CS	Preoperative Checklist	CS	5410	AFM 160-56
535	Mar72	ST	Meducak Certificate-Food Handler	ST	5483	AFM 161-6
536-1	Feb61	CS	Individual Pay Record	CF/1200	1813	AFM 177-204
538	* Apr73	CS	Personal Clothing and Equipment Record	CS	4200	AFM 67-1
539	Sep66	CS	Installed Equipment Inventory Worksheet(LRA)	CS	391[illegible]	[illegible] 87-10

Figure 2-2. Listing of forms in columnar format.

4. What does the "-1" in AFR 162-1 mean?

5. Which index should you use to answer questions concerning the currency, packaging, reproduction, or the prescribing directive for completing a particular form?

6. What does the entry "LRA" following the form title in AFR 0-9 mean?

7. What does a display dot mean when it appears in a column of AFR 0-9?

8. You know that AF Form 1466 has recently been replaced by a revised AF Form 1466. How can you find out whether or not to use the old forms that are on hand?

2-2. Dental Supply

Because the Air Force spends billions of dollars every year on supplies and equipment, all of us need to be cost-conscious and do all we can to get the most benefit possible at the lowest cost. In this section, we give you the information you will need to do this. We cover the basic information you need to deal with dental supplies at the local level. Of course, when you finally become a supervisor, you'll need to increase your knowledge. The following AFRs and AFMs give the guidance and additional information you will need: AFR 162-1, *Management and Administration of USAF Dental Activities*, Chapter 2; AFR 67-10, *Responsibility for Management of Public Property in Possession of the Air Force;* AFR 167-11, *Serving Medical Material Customers;* AFR 400-14, *Precious Metals Recovery Program;* AFM 67-1, Volume 5, *Air Force Medical Materiel Management System;* AFM 12-50, *Disposition of Air Force Documentation*.

Another source of valuable information for you is the Dental Investigation Service, USAFSAM/NGD, Brooks AFB TX 78235. They can answer any questions you have about dental supplies (i.e., the best, the most used, etc.). The Dental Investigative Service (DIS) also distributes AF-wide newsletters and briefs that list articles and letters about dental items.

One other source of important information for you is the Air Force Medical Materiel Letter (AFMML). This is a bimonthly publication that has such information as recalled items, modification information, newly stock listed items, availability data, and a depot backorder list. AFMML letters are numbered (#1-26 per year) and should be filed in numerical order.

429. Specify procedures for classifying and identifying Air Force material, and identify common medical supply items.

Classification and Identification of Supplies. For the purpose of accountability, AF material is divided into two types: expendable and nonexpendable. *Expendable items* are those items for which all accountability is dropped from the records when they are issued. Aspirin, eugenol, soap, and impression materials are examples of expendable items. *Nonexpendable items* are those items that retain their identity throughout the period of their use, such as dental units and chairs, autoclaves, and typewriters. Accountability must be maintained on official records for nonexpendable items. Many different supply items are needed for the operation of the Government services. Locating and ordering supplies would be almost impossible without supply classification procedures. All supplies routinely purchased by the Government are given a national stock number (NSN). This number is the means by which you identify, order, and store supplies.

National stock numbers are 13-digit numbers that identify the group, class, and specific identity of a supply item. For example, in the stock number NSN 6520-00-782-2624:

a. 65 identifies the medical group.
b. 20 identifies the item as dental.
c. 00 is the NATO code.
d. 782-2624 tells what the item is; in this case, dental floss.

Although most of the items needed for the operation of the dental clinic are classified as 6520 items, some are not. For instance, radiographic developer and fixer solutions are a part of the 6525 supply classification, which denotes X-ray items.

As you can see, there are times when items other then 6520 items are needed. Among the common medical supply classes which you may be ordering from are:

6505—Antibiotics, Narcotics, Anesthetics, Stannous Fluoride, Silver Nitrate, Disclosing Tablets, and Astringents.
6510—Cotton Rolls, Cotton Pellets, and Gauze Sponges.
6515—Hypodermic Needles, Sutures and Needles, Syringes, Barrels, and Plungers.
6520—Dental Equipment and Supplies.
6525—X-ray Film and Equipment.
6530—Sanitizers, Sterilizers, Autoclaves, Instrument Trays, Needle Jars, Soap and Detergent Dispensers, and Medicine Droppers.
6532—Dental Smocks and Patient Aprons.

Although most of the items you need are in the 65 group, there are items in other groups—such as the 68 group, which contains disinfectants and wetting agents—that you also may need. You can find a list of these common groups in the *Federal Supply Catalog* (FSC) for dental items. If you have difficulty finding the NSN of an item, ask the base medical supply activity for help.

Exercises (429):

1. Distinguish between expendable and nonexpendable supplies.

2. What do the first two digits of the FSN identify?

3. What do the second two digits of the FSN identify?

4. What do the last seven digits of the FSN identify?

5. Identify the common medical supply classes by matching the items in column A with the appropriate classes in column B.

Column A	*Column B*
_____ (1) Dental smocks and patient aprons.	a. 6525.
_____ (2) Cotton rolls and gauze sponges.	b. 6505.
_____ (3) Periapical and bitewing X-ray film.	c. 6532.
_____ (4) Hypodermic and suture needles.	d. 6520.
_____ (5) Dental equipment and supplies.	e. 6530.
_____ (6) Sterilizers and detergent dispensers.	f. 6510.
_____ (7) Narcotics and antibiotics.	g. 6515.

430. Identify true statements about Federal supply catalogs.

Federal Supply Catalogs. Both the Department of Defense (DOD) and the General Services Administration (GSA) publish Federal supply catalogs. Whenever possible, use these DOD publications to order your supplies. The DOD publishes a separate catalog for most classifications of supplies. For example, there is a separate catalog for 6505 items, 6510, 6515, 6520, etc. Both alphabetical and stock number indexes are in the front of the catalogs. Illustrations of many items are published when items are added, deleted, or revised. It is important that you keep your *Federal Supply Catalog* up to date so that you can get the latest items available and not waste time ordering items no longer stocked.

The GSA catalog has items in general use throughout the Federal Government. Unlike the DOD consolidated supply publications, the GSA catalog has a wide variety of items available from GSA supply distribution facilities. These items range from mops to file cabinets.

There are other supply sources. These are supply items listed in civilian catalogs and secured by Blanket Purchase Agreements (BPA's). A BPA is an open-ended agreement between medical materiel and a company to buy items of supply (not equipment). This is a method of getting needed supplies by bypassing the need to purchase the items through procurement each time an item is required. The term used for obtaining supply items through civilian catalogs or BPA's is known as *local purchase*. Local purchase (LP) items are those items not usually listed in the Federal Supply Catalogs or the GSA catalog, but are needed faster than normal ordering times allow. Requests for LP items are sent to and handled by the Base Contractors Office (BCO).

Exercises (430):

Indicate whether each of the following statements is true (T) or false (F). Explain any false answers.

_____ 1. The Department of Defense publishes a separate supply catalog for most classes of supplies.

_____ 2. A new supply catalog is published each time items are added, deleted, or revised.

_____ 3. The General Services Administration catalog contains a wide variety of items ranging from mops to file cabinets.

_____ 4. Both alphabetical and stock number indexes are located in the front of the catalogs.

431. Specify supply authorization procedures for dental clinics, and list the tables of allowance (TAs) that apply to Dental Services.

Supply Authorizations. While dental personnel use a variety of authorization documents to get clinic supplies and equipment, they most often use two tables of allowance (TA 891, *USAF Dental Clinic*, and TA 892, *Dental Laboratory*). These two tables tell what item each clinic needs to do its mission. Supply and equipment authorizations in these TAs are based primarily on the number of people the clinic serves.

The level of supply items authorize is considered a working level. This level does not normally exceed a 2-week supply of consumable items (for example, drugs, X-ray film, and silver alloy). It's also okay to keep necessary stocks of durable items, such as examining mirrors and pluggers. In addition, you may stock items that are infrequently used and items that are not stocked by the base medical supply activity. Normally, the base medical supply activity keeps a backup stock of the supplies that you order frequently.

Exercises (431):

1. What is the most common supply authorization document?

2. How does a supply authorization document assest dental personnel?

3. What tables of allowances apply to Dental Services?

4. Upon what factor are these allowances primarily based?

5. What level of consumable items is normally authorized?

6. What facility normally keeps a backup stock of the supplies you order frequently?

432. State procedures for managing supplies.

Supply Functions. The effective management of supplies requires many functions. Supplies must be ordered, received, stored, and issued; excess supplies and equipment must be turned in; records must be kept; and inventories must be conducted.

Ordering supplies. Normally, you will order a supply item based on its maximum level and reorder point. These levels are based on past issue experience and usage. When the shelf supply reaches the reorder point, you order the quantity needed to bring the shelf supply back up to the maximum level. The medical supply officer at your base decides how you are to request supply items—based on local medical OI's (operating instructions). Always check with the medical supply personnel for guidance on methods and forms to use in ordering supplies. You will get your supplies from a base medical supply activity, using one of the forms or methods listed below:

- DD Form 1348–6, NON-NSN Requisition (Manual).
- Telephone order system.
- Use of shopping list.
- Obtaining equipment and turn-ins from the medical equipment management office (MEMO), using AF Form 601, Equipment Action Request.

When you receive supplies from the base medical supply activity, check them against the issue document. All the items on the issue document will be charged against your account whether you receive them or not. Store the items in the supply room in stock number sequence.

Issuing. Issuing procedures in dental clinics vary according to local policies. Some clinics have designated times for issuing supplies to the using sections. Other clinics allow supplies to be drawn at any time of the duty day. Of course, regardless of the established procedures, emergency supply needs do occur, and someone in the clinic should have access to the supply room at all times.

Turn-in. Since excess and unserviceable items are of no value to your clinic, turn them in to the medical supply officer on DD Form 1348–6. Excess and unserviceable equipment items should be turned in to MEMO on AF Form 601.

Records. You must keep a file of all supply functions of the facility, including issue and turn-in documents. The document number assigned by medical supply may be used for control and filing purposes. Dispose of records in accordance with AFM 12–50.

Inventories. Inventory your equipment items annually or more often if the base dental surgeon (example, Self-inspection), the medical supply officer (example, OSI investigation), or higher authority (example, change of property custodians) thinks it's necessary. The purpose of an inventory is to reveal whether or not:

- Items are on hand and accountable.
- Items and quantities on hand are adequate.
- Items on hand are usable.
- Established levels are realistic.

Inventory narcotics and alcohol items at least monthly. Inventory other controlled medical items such as precious metals at least quarterly. Silver alloy is not a controlled item and does not require inventory as a precious metal or alloy. The director of Base Medical Services appoints a disinterested officer, or an NCO in the top three grades to perform inventories of controlled items.

Silver reclamation. Silver-bearing scrap materials are collected and turned in to Medical Supply. These materials include scrap amalgam, scrap radiographic film, silver points, and expended radiographic fixer solution. Silver-bearing scrap materials must be safeguarded until they are turned in, and you must be familiar with the local procedures that apply. AFR 400–14, *Precious Metals*

Recovery Program, provides direction for the accumulation, safeguarding, and turn-in of silver-bearing scraps. It is the responsibility of the base precious metals recovery officer to assist with any problems you may encounter. Contact this person for assistance with any problem you cannot resolve through your units' precious material recovery representative.

Exercises (432):

1. How do you determine how many supplies to order?

2. Who decides how supply items will be requested?

3. Why is it important to check the supplies you receive from medical supply against the issue document?

4. In what sequence are items usually stored in the supply room?

5. What policies determine issuing procedures within the dental clinics?

6. To whom should you turn in excess and unserviceable supplies?

7. To whom should you turn in excess and unserviceable equipment?

8. What is the purpose of inventories?

9. How often must inventories of equipment be made?

10. How often must inventories of controlled items be conducted?

11. Who performs inventories of controlled items?

12. Where must silver-bearing scrap material be turned in?

433. State the important points involved in property accountability and responsibility.

Property Accountability and Responsibility. Every member of the Air Force is responsible for the care of Air Force property. This is true even if the property hasn't been issued to the member or his or her unit. This responsibility includes pecuniary liability.

When you buy an article from any store, the moment the sales clerk completes the transaction the store drops its accountability. It then becomes your property and you are accountable and responsible for whatever use you make of it. Similarly, when a stock clerk issues an AF item to you, accountability ends for the issuing authority. However, you do not become the owner of the item; instead, the Air Force retains ownership and you assume responsibility for the care and protection of the item as provided by applicable regulations. Stated in other words, the property you use in your duties, whether it is a desk, a typewriter, a truck, or a grinding machine, is your responsibility. It is important to note that property responsibility is in no way lessened when an issuing authority ends it accountability.

Pecuniary liability. Personnel who have property responsibility as defined in AFR 67-10, *Responsibility for Management of Public Property in Possession of the Air Force,* also have pecuniary liability. Pecuniary liability means that personnel must make good (pay for) the loss, damage, or destruction of property resulting from their maladministration or negligence in its use, care, custody, or safeguarding from causes other then fair wear and tear. Pecuniary liability may be shared in any particular case by persons having command, supervisory, or custodial responsibility.

"Finders, keepers" may apply to some circumstances, but not to Government property. If you find Government property that has apparently been lost, stolen, or abandoned, you must assume responsibility for it and protect or care for it until it can be returned to the proper authorities.

Relief from property responsibility. There are many ways to be relieved of responsibility for a piece of property. Property may be turned back to Medical Supply as excess to a unit's needs. Other items may be transferred from the responsibility of one person or organization to that of another. Still other items may be damaged or lost due to the carelessness of the items custodians, in which case the person may be liable and may have to pay for the item. Relief from property responsibility occurs when the liable person has paid for the item.

Custodial responsibility for Air Force property changes when the property changes hands between authorized users. If you borrow even an Air Force pencil from another dental specialist, you assume custodial responsibilities for the pencil. The other person is relieved of custodial responsibility. The supervisory responsibility for property is changed by moving people into different jobs. However, if a person is designated "responsible property custodian" for a section or office, a formal written record of the transfer of the property responsibility must be made at the time the person moves to a new job. A "responsible property custodian" is an individual who is designated to handle a section's transactions with the supply unit.

Exercises (433):

1. Who is responsible for the care of Air Force property?

2. To what extent is property accountability lessened when the issuing authority has ended it accountability?

3. What does pecuniary liability mean?

4. When lost, stolen, or abandoned Government property is found, who is responsible for it before it is returned to the proper authorities?

5. How are changes made in custodial or user responsibility?

6. What must be done in regard to property responsibility when the responsible property officer for a section moves to another section?

434. Identify how to handle pecuniary liability for loss or damage cases.

Pecuniary Liability For Loss or Damage. There are three common ways to handle pecuniary liability. You may submit a Cash Collection Voucher, a State of Charges, or a Report of Survey.

The Cash Collection Voucher. When pecuniary liability is admitted and the responsible person is willing to pay the Government in Cash, the least troublesome way to settle a monetary obligation is to pay in cash. In such cases, use DD Form 1131, Cash Collection Voucher. Describe the items involved and the purpose for the payment.

The Statement of Charges. If an airman or civilian employee admits liability but can't pay cash, use DD Form 362, Statement of Charges for Government Property Lost, Damaged, or Destroyed. If an officer admits pecuniary liability and cannot pay in cash, use DD Form 114, Military Pay Order. Both of these forms authorize paycheck deductions. When either the Cash Collection Voucher or the Statement of Charges is used, the amounts involved must be less than $500. If the amount is $500 or more, use AF Form 198, Report of Survey of AF Property.

The Report of Survey. Whenever an individual will not admit pecuniary liability and when the amount involved is $500 or more, have a Report of Survey prepared. Two officers, the appointing authority and the investigating officer, are involved in the reports preparation. The appointing authority, usually the medical supply officer, appoints a survey officer (the investigating officer) to make a detailed and impartial investigation (survey) of the circumstances connected with the loss, damage, or destruction of the property described on the Report of Survey.

Sometimes circumstances don't warrant a survey officer. In these cases, the appointing authority may make a recommendation and forward the Report of Survey to the base commander for review and approval. As a result of the findings, the person responsible for the custody of the property in question may or may not be required to pay for it.

Exercises (434):

1. Identify which procedure should be instituted for each of the pecuniary liability situations listed in column A by matching the situation to the procedure in column B.

Column A

_____ (1) Used if an airman or a civilian employee admits to liability of less than $500 but does not have the cash to pay.

_____ (2) Used when an individual will not admit pecuniary liability and when the amount involved is over $500.

_____ (3) Used when an officer admits pecuniary liability and cannot pay in cash.

_____ (4) Used when an individual admits to pecuniary liability of less than $500 and agrees to pay in cash.

Column B

a. Report of Survey of AF Property (AF Form 198).
b. Cash collection voucher (DD Form 1131).
c. Military Pay Order (DD Form 114).
d. Statement of Charges for Government Property Lost, Damaged, or Destroyed (DD Form 362).

2. Who are the two officers directly concerned with preparing a Report of Survey?

3. What may result from the findings of a Report of Survey?

435. State procedures for handling equipment repair.

Equipment Maintenance Liaison. When dental equipment breaks down, turn it in or report it to the dental supply section. This section will arrange for the item's repair. In most cases, the medical equipment maintenance section will do the repair. But when such a facility is not available on your base, you'll need to contact Medical Supply. This office will then schedule repair by a civilian firm, send the equipment to a base where equipment repair facilities are available, or, if necessary, schedule a maintenance visit by a biomedical equipment technician (BMET) from your support base. Regardless of the action required to repair the item, follow local policies on reporting and scheduling equipment repair and preventive maintenance.

Any new construction, maintenance, and repair of the dental facility is done by the base civil engineering (BCE) group. In determining your facility's work requirements, you and the hospital plan manager will work in coordination with the base dental surgeon and appropriate personnel. The hospital plant manager or civil engineer liaison officer will coordinate your work requests with the BCE. Your work requests may be handled on a service call basis or a work order basis.

A service call will usually remedy minor emergency repairs, such as leaky faucets, ceiling and floor tile repair, and electrical outages. If the work cannot be performed on a service call, you'll need to fill out a work order request. A work order is submitted on AF Form 332, BCE Work Request, by the hospital plant manager. This form identifies the work to be done, specific justification for the work, and your priority and other miscellaneous information.

Exercises (435):

1. In most instances, what unit will the dental supply section notify when dental equipment breaks down?

2. On bases where medical equipment repair facilities are not operating, what avenues are available to get equipment repaired?

3. Who handles new construction, maintenance, and repair of a dental facility?

4. What type of work will base civil engineers handle on a service call?

5. What must you do to have work done that cannot be handled on a service call?

CHAPTER 3

Dental Instruments

ONE OF YOUR MOST important duties is to provide the dentist with the proper dental instrument at the right time. To do this, you must have a thorough knowledge of the many dental instruments and able to anticipate the needs of the dentist. Because dentists vary in the techniques they use for a given dental procedure, each may use different instruments, and you must have the right instrument ready at the right time. In this chapter, you will learn about the instruments used for the treatment of dental conditions and sharpening techniques for different classes of instruments.

3-1. Classification of Instruments

Because there is such a large quantity of instruments, there is a system for distinguishing one instrument from another. Instruments are classified or identified through a combination of several factors.

436. State the factors used for the identification of dental instruments.

Instrument Parts. There are three main parts of a dental hand instrument: the handle, the shank, and the working end. The handle, of course; is the part which is held in the operator's hand. Some instruments, such as mouth mirrors have detachable handles. This lets you replace the shank and working end without purchasing a new handle. The shank is the tapered connection between the handle and the working end. The working end, of course, is the part designed to perform a certain operation. It can be either a blade or a nib. The blade is the cutting end of cutting instruments, whereas the nib is the working part of condensing instruments. Figure 3-1 illustrates the parts of dental hand instruments.

Classification Names. The names of dental hand instruments are derived from association with one or a combination of the following classification factors:

a. The purpose of the instrument—excavating, scaling, and condensing.

b. The position or manner of use—hand condenser, automatic mallet, and push scaler.

c. The shape of the working end—file, chisel, spoon, and hatchet.

d. The angle of the working end in relation to the handle—biangle.

An example of a combination of the above classification factors is the biangle chisel.

Instrument Numbers. In addition to the classification names, instruments are also numbered. Normally, two different numbers appear on the handle of most dental hand instruments. One is an identification number; the other is a formula number. Also, the instruments may carry an abbreviation (Bl, Wds, Hol). These abbreviations are references to the instrument's designer (Black, Woodson, Hollenbeck). These references also help to identify the instrument.

Identification numbers. These numbers are normally on the portion of the handle farthest from the working end of single-ended instruments and near the center of double-ended instruments. As their name implies, they identify the instrument. For instance, there are five of Black's condensers of various sizes and shapes. The identification makes it possible to distinguish one from another when the dentist requests an instrument or you are ordering one from Base Supply.

Formula numbers. Formula numbers fully describe the instrument, and because of their length, are not primarily used for identification purposes. The formula number is a group of numbers, which is normally located on the handle, near the working end, of most dental hand instruments. They describe the width, length, angle, and sometimes the angle or curvature of the instrument blade.

Exercises (436):

1. Name the three main parts of a dental hand instrument.

2. What name applies to the working end of condensing instruments?

3. What factors are associated with an instrument's classification name?

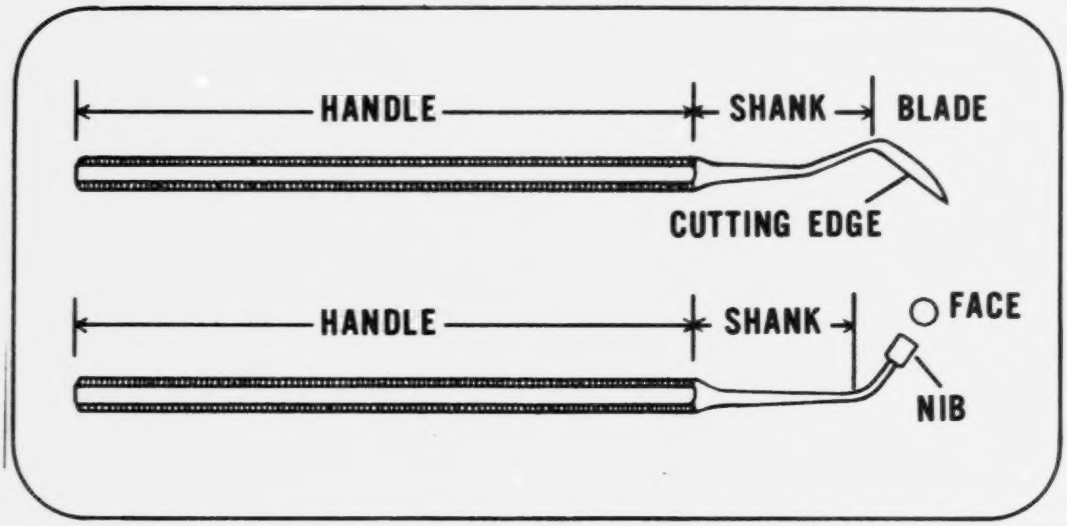


Figure 3–1. Parts of dental hand instruments.

4. Where on an instrument's handle does the identification number usually appear?

5. What numbers on the instrument's handle describe the width, length, and angle of the instrument's blade?

3-2. Diagnostic Instruments and Aids

In discussing diagnostic instruments, we should point out that they often have functions other than diagnosis. Normally, the diagnostic group is a mouth mirror, an explorer, and dressing forceps. These three instruments are placed on the bracket table before almost all dental procedures. Diagnostic aids help in making or confirming the dental officer's diagnosis. (Refer to FO 8.)

437. Given an illustration of diagnostic instruments and aids used in dentistry, identify each by use and name.

Mouth Mirrors. Mouth mirrors (FO 8) are used to view the hard-to-see areas in the mouth, to retract tissues, and to reflect light into dark areas of the mouth. Since mouth mirrors often become scratched and clouded, you must inspect them often and take corrective action. As we mentioned earlier, the mouth mirror has a detachable handle. Simply unscrew the shank and mirror portion and screw a new one into the handle. The Air Force stocks three types of mouth mirrors: the plane glass with a front reflective surface, the plane glass with a glass-covered reflective surface, and the magnifying mouth mirror.

The mirror with the front reflective surface produces the most accurate image of the item being reflected. Handle these mirrors with extra care because the reflective surface is on the top of the glass and is easily marred and scratched.

The glass-covered reflective surface mirror is the most common in Air Force dental clinics. However, since the reflective surface is glass covered, the "ghost" image it produces is a disadvantage.

The magnifying mirror produces an enlarged image. This mirror is used when minute detail is required in a dental treatment procedure.

Explorers. The explorer is another dental instrument used in many dental procedures. Explorers have sharp-pointed working ends called tines. This instrument is usually considered a diagnostic instrument, because it is used to detect small cavities and to check the depth of cavities. The dental officer also uses explorers to probe for foreign bodies, to determine the margin quality of fillings, and to detect fractured tooth enamel. Explorers are available in various sizes and shapes. You may find one each of several kinds, or all of one kind, in the dental treatment room you maintain. Be sure to replace explorers with broken or bent tines (FO 8). A third instrument usually in the diagnostic group is the dressing forceps.

Dressing Forceps. Dressing forceps are curved, tweezerlike instruments (FO 8). They are used in many dental treatment operations. In the examination section, the dental officer uses dressing forceps to carry cotton pellets for drying teeth or cavities. Used in this way, they are diagnostic instruments. Since they are used to carry cotton pellets, they are often referred to as cotton pliers or cotton forceps. Dressing forceps are sometimes used to apply medicaments and dressings. You should place a pair of dressing forceps along with a mouth mirror and explorer on the bracket table for almost every dental procedure. Other items the dentist uses to make a proper diagnosis are called diagnostic aids and include the transilluminator, vitalometer, radiograph, and clinical thermometer.

Transilluminator. The transilluminator also may be referred to as a diagnostic lamp. It is a small mouth lamp found in some dental operating units. By directing this light through the gingival tissues, the dentist can detect certain gingival fluids, calculus, and foreign bodies. There is also a battery-operated transilluminator that is sometimes made available when dental operating units are not equipped with one. Maintain these lamps by keeping them clean and disinfected. Do not try to sterilize transilluminators with any heating type of sterilization. The outer case is made of plastic and is deformed at heat sterilization temperatures. Disinfect them with an approved disinfecting chemical agents. Another diagnostic aid operated by electrical power is the vitalometer.

Vitalometer. The vitalometer (FO 8) is another device found on some dental operating units and is available as a portable kit. Some of those found on a dental operating unit operate from the same handle as the transilluminator. Other units have a handle for each diagnostic aid. The vitalometer also is known as the pulp tester and is used to determine the vitality of pulp-nerve tissues in teeth. It actually passes electrical current to the tooth. With the vitalometer, the operator can start at zero and gradually increase the amount of current until there is a mild reaction from the patient. The sensation produced by the vitalometer on a tooth has been described as a "tingling feeling." The vitalometer is shown in foldout 8. Like the transilluminator, the vitalometer tip must be disinfected with a chemical solution—not with heat-type sterilization. A different type of diagnostic aid is the dental radiograph.

Dental Radiographs. Dental radiographs, also known as dental X-rays, are very valuable as diagnostic aids. They are similar to small photographic negatives. (A periapical dental radiograph is shown in FO 8.) In this respect, a radiograph is a shadow image of a substance or body projected on radiographic film. The dentist looks at a dental radiograph as a negative image of the tissues of the mouth and is able to diagnose, with the use of dental radiographs, oral conditions that would otherwise have been invisible. Dental radiology will be covered in greater detail in Volume 4, Chapter 1. One other aid frequently used by the dentist is a clinical thermometer.

Clinical Thermometer. The clinical thermometer has proved to be very valuable in helping a dentist make a correct diagnosis. A clinical thermometer is shown is foldout 8. Sometimes, infections in the oral cavity increase body temperature. Whenever the dentists suspect that infection is present, they can use a thermometer to verify the tentative diagnosis. Keep thermometers disinfected in a cold, chemical solution. Some authors might include other items as diagnostic aids, but those we have presented are the primary ones used in the Air Force Dental Service.

Exercises (437):

1. Identify the diagnostic instruments illustrated in foldout 18, exercise 437.

2. Complete exercises a through e by placing the appropriate letter from foldout 18, exercise 437, in the space provided.

_____ a. This instrument is used to detect small cavities and to check the depth of cavities. It is also used to determine the marginal qualities of fillings and to detect fractured tooth enamel.
_____ b. This instrument is used to direct light through the gingival tissues to detect certain gingival fluids, calculus, and foreign bodies.
_____ c. This instrument is used to carry cotton to dry the teeth and apply medicaments and dressings.
_____ d. This instrument is used to view hard-to-see areas of the mouth, retract soft tissue of the mouth, and reflect light into dark areas.
_____ e. This instrument is used to determine the vitality of pulp-nerve tissues in teeth.

3-3. Rotary Instruments

The rotary instrument group includes the greatest number of small separate items. These instruments are made from many materials and combinations of materials ranging from diamonds to very finely detailed steel. Rotary instruments have many uses, among which are preparing cavities, finishing restorations, trimming dentures, polishing teeth, and removing bone in oral surgery cases. The rotary instruments are a vital part of most dental treatment procedures. Your role with this group ranges from keeping an adequate number in the treatment room to changing them in the handpiece. Rotary instruments may be classed as burs, disks, wheels and points, and polishers. They are designed for use in one of three different handpieces.

438. Identify the types and uses of the burs used in dentistry.

Handpieces. You have already learned that there are several types of handpieces used in dentistry. Each rotary instrument is used in a particular handpiece. To indicate in which handpiece rotary instruments function, they have been classed as friction grip, straight handpiece, or angle (latch) handpiece types. The friction grip instruments are abbreviated FG and are used in ultra-speed handpieces. These instruments have a small shank and are held in the handpiece by friction against a metal or plastic chuck. The straight handpiece rotary instruments are abbreviated SHP. They are used in conventional straight handpieces and slow-speed, air-driven straight handpieces. The shank on SHP instruments is larger in diameter than the FG shank and at least twice as long. The angle handpiece instrument is abbreviated as the AHP type. This instrument is used in conventional contra-angle handpieces. Common AHP rotary instruments have the same diameter as SHP instruments but are about half the length. However, some AHP instruments are made with what is termed a short shank. Foldout 8 shows the latch-type, straight handpiece, and friction grip burs. Let's go on to consider one family of the rotary instrument group called burs.

Dental Burs. Dental burs are available in many sizes and shapes and are made of either steel or tungsten carbide. They are used in nearly all sections of the dental clinic. Dental burs are further classed as excavating, finishing, denture trimming, and dental surgery instruments.

Excavating burs. The dental burs dentist used to prepare cavities are known as excavating burs. They are designed for specific functions ranging from removing decay to making undercuts. Excavating bur designs are round, inverted cone, straight fissure, tapered fissure, and end cutting. Foldout 8 shows the various excavating bur designs.

a. Round burs are, as the name implies, in the shape of a sphere on a shank. They are numbers 1/4, 1/2, 2, 4, 6, and 8, with the largest number being the largest in size (as in all groups of burs). (See FO 8, bur sizes.) They are also available in steel and tungsten carbide for some numbers and for use in contra-angle, friction grip, or straight handpieces. One exception is that all numbers may not be available for each handpiece. Round burs are designed to gain entrance into tooth structure and to remove decayed tooth substance.

b. Inverted cone burs are shaped, as the name indicates, like small cones inverted on the shank. In the *Federal Supply Catalog*, these burs are numbered 33½, 35, 37, and 39, with number 39 being the largest. There may be variations in the metal quality and sizes available for each handpiece. Inverted cone burs are designed to make undercuts in the cavity preparation. These undercuts are necessary to provide proper retention because the filling materials might fall out of the prepared cavities.

c. Straight fissure burs are small cylinders with grooves machined into their outer walls. These grooves are either plain or crosscut. The plain fissures have semispiral grooves running generally lengthwise on the small cylindrical working end of the bur. The straight crosscut fissure burs are numbered 557, 558, and 559 in the *Federal Supply Catalog*. Most of the crosscut fissure burs are made from tungsten carbide. The straight plain fissure bur is number 57 in the *Federal Supply Catalog* and is available in the friction grip style only. Straight fissure burs are used mainly to smooth and shape cavity walls.

d. Tapered fissure burs are small tapering cylinders with grooves machined into their outer walls. Like the straight fissure burs, the grooves on tapered fissure burs are available as plain or crosscut. The *Federal Supply Catalog* lists the crosscut tapered fissure burs as numbers 699, 700, 701, 702, and 703. Most tapered fissure burs are made from tungsten carbide, and some numbers are not available for all three handpieces. The plain fissure tapered burs are also made of tungsten carbide and are for use in friction grip handpieces (ultra-speed handpieces). There are two plain tapered fissure burs listed in the *Federal Supply Catalog*. They are numbered 169L and 170L. Tapered fissure burs are used to smooth and shape the walls of a cavity preparation as are straight fissure burs. However, tapered fissure burs are particularly useful in preparing teeth for inlay and full crown restorations.

e. End cutting burs are small cylinders with the tip of the cylinder designed to cut tooth structure. The number 901 identifies this type bur in the *Federal Supply Catalog*. It is available in both the friction grip and contra-angle types. The end cutting burs are used to shape and finish the gingival floor for crown and fixed partial denture preparations without the risk of removing more tooth structure from prepared cavity walls. All of the burs we have discussed thus far are mostly used to remove tooth structures. Other types of burs are used to perform different functions and are divided accordingly. One of these is the finishing bur.

Finishing burs. Finishing burs are used to smooth and shape tooth-restoring materials. These burs are available in various shapes to enable the dentist to recreate, as closely as possible, the original shape of the tooth. Finishing burs are made of steel and are for use in contra-angle and straight handpieces. These burs are easily differentiated from excavating burs by the fineness of the cutting blades on the working ends. Finishing burs for use in contra-angle handpieces are numbered 6, 200, 218, 224, and 242 in the *Federal Supply Catalog*. Those available for use in the straight handpieces are numbered 200 and 224. The shapes of finishing burs are easily described. The #6 bur is a rounded pear shape; the #200 is round and often mistaken for a round excavating bur. Bur #218 is oval shaped, #224 is bud (flowerbud) shaped, and #242 is sugarloaf or flame shaped. Another category of burs is the denture trimming variety. Foldout 9 shows finishing burs.

Denture trimming burs. Denture trimming burs are used to trim acrylic resin denture base materials. These burs are available for use only in the straight handpiece. Denture trimming burs are also used in lathes found in the dental laboratory. Denture trimming burs are made of steel, and the working end is nearly as large as the crown of a tooth. The *Federal Supply Catalog* lists these bur shapes as flame, pear, and round. (See FO 8.) The last examples of dental burs are the dental surgery burs.

Dental surgery burs. Dental surgery burs are used either to cut bone or cut tooth structure. Foldout 9 illustrates the surgical burs.

a. The Henahan #41 bur is used to cut bone. It is sometimes used to remove the bone covering an impacted third molar. The Henahan #41 is a steel bur and is available for either the contra-angle (AHP) or the straight handpiece (SHP).

b. The #703 straight handpiece bur is listed in the *Federal Supply Catalog* as a dental surgery bur. It is made of tungsten carbide, which makes it suitable for cutting either bone or the harder tooth structures. The oral surgeon uses this bur to completely or partially section a tooth for easier removal.

Exercises (438):

In exercises 1 through 8, identify the type and uses of dental bus by placing the appropriate letter or letters from foldout 18, exercise 438, in the space provided below each question.

1. Which burs are designed for use in the:
   a. Latch-type handpiece?

   b. Straight handpiece?

   c. Ultra-speed handpiece?

2. Which burs are classified as finishing burs?

3. Which burs are used to cut bone or tooth structures during oral surgery procedures?

4. Which bur is designed to make undercuts in the cavity preparation?

5. Which bur is used to trim acrylic resin denture base materials?

6. Which burs are classified as excavating burs?

7. Which excavating bur is designed to gain entrance into tooth structure and to remove decayed tooth substance?

8. Which bur is called an end cutting bur?

9. In the spaces provided, enter the number(s) used to identify the following excavating burs:
   a. End cutting. ________________
   b. Inverted cone. ________________
   c. Tapered fissure. ________________
   d. Round. ________________
   e. Straight fissure. ________________
   f. Plain tapered fissure. ________________
   g. Plain straight fissure. ________________

439. State the types and uses of the abrasive disks, wheels, and polishing instruments used in dentistry.

Abrasive Disks. Abrasive disks are circular-shaped cutting instruments. Dental officers use them to cut tooth restorations. Disks are available in a wide variety of sizes, shapes, and abrasive grit. They are designed for use in contra-angle and straight handpieces. (See FO 9).

Manufacturers provide abrasive disks either mandrel mounted or unmounted. A mandrel is the shaft upon which a disk is mounted at one end while the other end inserts into the handpiece. Mandrels are available for contra-angle and straight handpieces. Some mandrels are designed to hold disks in place by spring tension; whereas, others are designed with a small screw in one end. Other mandrels are permanently mounted to disks, such as certain types of diamond disks.

Small diamond chips are one type of cutting material used on abrasive disks. These diamond chips are bonded to a metal base which makes a very effective enamel-cutting disk. The surface plane on diamond disks ranges from flat to concave to convex and usually has one side covered with abrasive chips while the other side is free of abrasives. Such disks are called safe-sided disks.

Other abrasives used in the fabrication of abrasive disks are aluminum oxide, flint, garnet, and silicon carbide. Aluminum oxide abrasives are available on either metal or plastic-backed disks. Flint, garnet, and silicon carbide abrasives are bonded to paper or plastic-backed disks. Some disks, such as the separating variety, are made only of silicon carbide and are pressed into the form of a double-sided abrasive disk held together by a bonding material. Another of the rotary instruments is the abrasive wheel.

Abrasive Wheels and Points. Abrasive wheels and points are very similar to abrasive disks. They primarily are used to reduce and smooth high spots on restorations or prosthetic devices. Like disks, wheels and points are mandrel mounted and unmounted and use some of the same abrasives. (See FO 9.) The greatest difference is in the shape of the working ends. Generally speaking, disks are thinner and usually have abrasives on only one side. Wheels and points usually have abrasives on both sides and on the outer edges as well. Furthermore, wheels and points are made with different types of abrasives. For example, rubber impregnated with pumice or silicon carbide and glass is used to fabricate abrasive wheels. Still another difference is that some wheels and points are available for use in ultra-speed handpieces, whereas disks are designed for use in conventional speed contra-angle or straight handpieces. The last type of rotary instruments is the polisher type.

Polishing Instruments. Polishing instruments are usually used in conjunction with an abrasive to remove stains or to polish teeth, restorations, and dental appliances. These polishers come in three forms: cup, brush, or buffing wheel. (See FO 9). The polishing cup is made of rubber and is used to polish teeth and restorations. These cups are designed to screw into a slow-speed, right-angle (prophylaxis) handpiece or into a contra-angle mandrel. An abrasive pumice is used with the polishing cup when polishing natural teeth. The polishing brush is designed to screw into the right-angle handpiece like the polishing cup. It is made of natural bristles (swine hair) mounted on a screw stem. The polishing brush is used to remove stains from tooth fissures and other areas that the polishing cup cannot reach. The wheel-type polishers are designed for use primarily in the dental laboratory for polishing dentures and other prosthodontic appliances. They range in diameter from 3/4 inch to 4 inches. Some of the materials used to fabricate these wheels are chamois, felt, cloth, and fiber bristles.

You must have the necessary rotary instruments available for use in your assigned dental treatment room. You must also properly clean, disinfect, sterilize, and store all dental instruments. Generally speaking, you should clean excavating burs with a scratch brush and sterilize them in the autoclave. Paper and plastic-backed abrasive disks will be discarded after one use. Some steel burs should be discarded after one use. Other abrasive disks and wheels are disinfected in a chemical solution rather than autoclaved. Autoclaving temperatures will affect the abrasive bond (glue). All instruments to be placed in the patient's mouth should be sterilized by autoclaving or by using dry heat if at all possible.

Exercises (439):

1. What is a mandrel?

2. What name applies to a disk that has one side covered with abrasives and the other side free of abrasives?

3. For what purposes would a dental officer use abrasive disks?

4. What are the primary uses of abrasive wheels?

5. What is the general difference between abrasive disks and wheels?

6. What type of handpieces can be used with abrasive disks?

7. For what tasks are polishing instruments usually used?

8. How are the polishing cups and brushes used for prophylaxis secured in the right-angle handpiece?

9. For what use would a 3-inch diameter polishing wheel be employed?

10. Why must some rotary instruments be disinfected rather than sterilized?

3-4. Miscellaneous Dental Instruments

Whenever attempts are made to divide a large group of associated items into logical subdivisions, it is practically inevitable that some problems arise. This, of course, occurs with dental instruments. Most dental items can be directly or primarily associated with a particular dental specialty; some, however, cannot. We can, however, combine some items in a "miscellaneous section." In this section, we will cover anesthetic syringes, rubber dam instruments, the vernier caliper, cotton roll holders, the saliva ejector mouthpiece, and the napkin holder. Refer to foldout 9 as we cover these instruments.

440. Identify correct statements about items classed as miscellaneous dental instruments.

Anesthetic Syringes. Anesthetic syringes are used in dentistry to inject a local anesthetic. These syringes differ from most syringes because they are designed to inject anesthetic from a carpule. There are basically two types of syringes (FO 9): the aspirating and the nonaspirating. They look similar, but the aspirating syringe has a small "harpoon" on the plunger that imbeds itself into the rubber stopper of the carpule. This lets the dental officer do an aspiration to see if he or she has entered a blood vessel. These syringes use disposable needles that are available in different gauges and lengths. Normally, you fit the syringe with a short needle (13/16 inch in length) for maxillary injections and a long needle (1 ⅞ inches in length) for mandibular injections.

Rubber Dam Instruments. The rubber dam instrument set includes the rubber dam punch, rubber dam clamps, rubber dam clamp forceps, and rubber dam holder. These instruments prepare and maintain the position of thin sheets of latex rubber. The rubber dam itself is used to isolate a designed tooth or teeth in the mouth before certain restorative or endodontic procedures. The rubber dam actually keeps mouth fluids, tissues, and the tongue away from the operation site. (Refer to FO 9.)

Rubber dam punch. The rubber dam punch is used to make the necessary spaced holes in the rubber dam. The working end is designed with a plunger on one side and a wheel on the other side. This wheel has different sized holes on the flat surface facing the plunger. These features let the operator select and adjust the wheel to punch the desired diameter hole in the rubber dam.

Rubber dam clamps. After the rubber dam has the required number of holes punched, it is then stretched to fit over each designated tooth. To maintain a snug fit around the neck of the tooth, a rubber dam clamp is used. These clamps are made of spring steel in various sizes to fit the general contours of the different teeth. The space between the gripping edges is narrower than the diameter of the corresponding tooth. Thus, to place the clamp around the tooth, it is necessary to spread the gripping edges wider than the tooth diameter. To spread the gripping edges, a rubber dam clamp forcep is used.

Rubber dam clamp forceps. The rubber dam clamp forceps are designed to spread the two working ends apart when the handles are squeezed together. The working ends have small projections that fit into two corresponding holes on the rubber dam clamps. The area between the working end and the handle has a sliding lock device. This sliding lock device locks the handles in position while the dentist moves the rubber dam clamp around the tooth.

Rubber dam holder. To place and clamp a rubber dam around the tooth is not enough. The dentist still needs something to hold the loose outer edges of the rubber dam sheets so he or she can see and have access to the tooth being treated. This need is met with an instrument called the rubber dam holder. Most of the rubber dam holders used today are U-shaped. One of the most popular ones is called the Young's frame. When the edges are connected to the small, sharp projections on this U-frame, there is adequate access to, and visibility of, the area of treatment.

Vernier Caliper. The vernier caliper is frequently called the Boley gauge. This instrument is calibrated in millimeters. It is used for precision measuring in the endodontic and prosthodontic treatment rooms and the dental laboratory. You can measure with the vernier caliper whether using the side with points marked A and B or the opposing side having points Y and Z. (See FO 9).

Saliva Ejector Mouthpieces. Saliva ejector mouthpieces are connected to saliva ejector hoses on dental operating units. This combination removes excessive saliva and small particles of debris from the patient's mouth. In this manner, the area being treated remains fairly free of obstructing fluids, which lets the dental officer work continuously. These saliva ejector mouthpieces are available in two types: metal and plastic. The metal type can be cleaned, resterilized, and reused; however, most dental clinics now use the disposable plastic type. The plastic type offers several advantages over the metal type. Namely, plastic saliva ejector mouthpieces are conveniently discarded after use; they may be easily bent to the desired shape; and because of their softer and flexible quality, they add to patient comfort. We are now ready to consider the last item in the miscellaneous group, the napkin holder.

Napkin Holder. The napkin holder is commonly called a towel chain. It is used to hold a towel or paper napkin around the patient's neck during dental treatment procedures. It is a chain similar to the one which holds your identification tag around your neck; however, it has a small alligator clip on each end.

Exercises (440):

Indicate whether the statements below are true or false by placing a T or F in the blank provided. Explain any false answer.

____ 1. You can easily distinguish the nonaspirating syringe from the aspirating syringe because the plunger of the nonaspirating syringe has a small, harpoon-type tip.

____ 2. The anesthetic syringes used in dentistry are designed to inject anesthesia from a carpule.

____ 3. Short anesthetic needles are usually used for maxillary injections.

____ 4. The rubber dam is used primarily in the oral surgery section.

_____ 5. The rubber dam punch produces the same size hole in the rubber dam for each tooth.

_____ 6. Rubber dam clamps are made of spring steel in various sizes to fit the general contours of the different teeth.

_____ 7. Most of the rubber dam holders used today have an X-shape.

_____ 8. The vernier caliper is commonly called a Boley gauge.

_____ 9. The vernier caliper would never be used in the endodontic section.

_____ 10. The saliva ejector mouthpieces preferred by most clinics are constructed of plastic.

3-5. Cutting Instruments

Many dental procedures require the use of instruments with sharp cutting edges. Because of the many hard-to-reach areas in the human mouth and the various functions required, we find cutting instruments in a wide variety of sizes and shapes. The cutting instruments we discuss in this section are those that are primarily used in restorative dentistry. This cutting instrument group includes chisels, hatchets, hoes, gingival margin trimmers, and excavators. Other dental instruments have cutting edges but are usually included in a different group, such as the oral surgery or periodontic group. Refer to foldout 10 as you study the restorative cutting instrument group.

441. Identify the cutting instruments used in restorative dentistry.

Chisels. Dental chisels are described frequently as miniature wood chisels. They usually have a cutting edge at a right angle to the axis of the blade. Chisels are used to cleave (split) tooth enamel, to smooth cavity walls, and to sharpen line and point angles. Each chisel is designed to reach specific areas of the mouth. You need to be careful in handling chisels, because the cutting edges are dulled very easily. Even though dental instruments are made from the finest metals available, a slight blow of the cutting edge against a metal object greatly reduces their cutting ability. Some dental chisels are single ended, whereas other have cutting edges on both ends. Basically, two types of restorative chisels are used in restorative dentistry.

Wedelstaedt chisels. The Wedelstaedt chisels are a paired set of chisels. The two cutting types are beveled in opposite directions. The Wedelstaedts have slightly curved shanks and are used primarily on anterior teeth. Foldout 10 displays the double ended Black #3, #4, 5, and #6 chisels.

Biangle chisels. The biangle chisels have two distinct angles; one at the shank and one at the working end. This design allows access to tooth structures that would not be possible with straight chisels. A double-ended version of the biangle chisel is the Black #40 and #41. (See FO 10.)

Excavators. Among the dental hand instruments is the excavator group. In this instrument group are the hatchets, hoes, spoons, and other variations (claw, disk, and gouge) of the spoon-shaped working end.

Hatchets. A dental hatchet resembles a camper's hatchet, except much smaller. Like dental chisels, some have single cutting ends, and others have cutting edges on both ends of the handle. Hatchet blades are set at a 45° to 90° angle from the handle and shank. These instruments have different lengths and widths of blade. Hatches are used on the walls of the cavity preparation to cleave enamel and cut dentin so that there will be a sharp cavity outline.

Bibevel hatchets. The bibevel hatches carry the instrument identification numbers of 8, 17, and 23. As the name implies, their cutting end has a bibevel. The difference between these three instruments is the size of their working ends. The #8 hatchet has the largest working end and the #23, the smallest.

Single bevel hatchets. There are two pairs of single bevel hatchets, and they are supplied as four single-ended instruments. The identification numbers of these instruments are 51, 52, 53, and 54. Two double-ended hatchets are available. These are the Black #15, #16, #17, and #18. The two working ends make a pair. The instruments that form pairs are the same size; however, their cutting edges have opposite bevels to allow access to different areas of the mouth. (See FO 10.)

Hoes. As you may have guessed, dental hoes look like a garden hoe in miniature. Like the dental hatchets, dental hoes are also included in the dental excavator group. They are used very effectively to smooth and shape the floor of cavity preparations and to accentuate grooves or retention points. The identification numbers of the dental hoes are 29 and 34.

Spoon-type excavators. This portion of the dental excavator family is made up of spoon-, claw-, disk-, and gouge-shaped blades. (See FO 10.) They are primarily used to remove carious debris from tooth cavities. Their tips and sides are designed for cutting action. These instruments are often referred to as spoons because their blades somewhat resemble minature spoons. Excavators are occasionally used for carving wax inlay patterns and for carving amalgam restorations. Each instrument of the pair is designed for access to different areas of the teeth. Double-ended versions of this type of spoon are the Black #36, #37, #38, and #39.

Gingival Margin Trimmers. There are two pairs of single-ended gingival margin trimmers in the Air Force inventory; these are Black #77, #78, #79, and #80. The two instruments making a pair are the same size; however, their working ends have opposite curvatures and bevels. (See FO 10.) As the name implies, gingival margin trimmers are used to trim, smooth, and shape the gingival floor of a cavity preparation. These instruments are available in either single-ended or double-ended styles. There are four double-ended gingival margin trimmers. They are the Black #26, #27, #28, and #29. Gingival margin trimmers are also used to sharpen line angles on the gingival floor for better amalgam retention and to level the gingival floor on inlay preparations.

Exercises (441):

Foldout 18, exercise 441, shows the shank and working end of several cutting instruments. Each instrument is identified by a letter. In exercises 1 through 8, place the identification letter of each cutting instrument shown in foldout 18, exercise 441, in the appropriate space.

_____ 1. Gingival margin trimmers.
_____ 2. Spoon-shaped excavator.
_____ 3. Biangle chisel.
_____ 4. Wedelstaedt chisel.
_____ 5. Hatchet-shaped excavator.
_____ 6. Hoe-shaped excavator.
_____ 7. Disk-shaped excavator.
_____ 8. Claw-shaped excavator.

3-6. Dental Matrices

If the walls of a tooth have been destroyed by decay or have been removed during the course of cavity preparation, they must be restored with restorative material. To do this, the dentist uses a matrix to approximate the original walls and to hold the filling material in proper form and position until it has time to harden. This matrix is similar to the "forms" builders use to hold semiliquid concrete in proper form and place until it hardens. Whereas builders use plywood, 2X4s, and nails to make their forms, the dental officer uses matrix retainers and materials to get the same effect. These matrices include matrix retainers, metal bands, wedges, matrix strips, and plastic crown forms. Refer to foldout 10 as we cover the matrices.

442. Identify true statements about the types and uses of dental matrices.

Matric Retainers. Matrix retainers are used to hold the matrices (metal bands or strips) firmly in place around a tooth. Matrix retainers and metal bands are used in combination to form a temporary mold while filling material is being packed into place. These retainers have either small hooks or retaining screws at one end to hold the matrix band. On the other end of the retainer is an adjusting screw. When the dentist adjusts the screw clockwise, the band loop constricts. When the dentist turns the screw counterclockwise, the loop loosens. The *Federal Supply Catalog* lists two types of matrix retainers; the Tofflemire and the #1. (See FO 10.) The Tofflemire retainer is available in three different designs: the universal straight, the contra-angle, and the contra-angle junior size. These retainers are practically maintenance free. They can be heat sterilized along with other dental instruments. Your part in maintaining matrix retainers is to check them periodically and replace those with badly worn screw threads. You are also expected to attach the correct matrix band to the appropriate retainer in anticipation of the dental officer's needs.

Matrix Bands. Matrix bands are very thin, flexible, stainless steel bands that either partially or totally inclose a tooth. There are three basic bands: molar bands, bicuspid bands, and pedodontic bands. The bands used with the Tofflemire retainers completely encircle the tooth. The bands used with the #1 retainer partially encircle a tooth in a horseshoe or U-shape. Matrix bands come in assorted sizes and shapes in small envelope-type packages. A dentist usually prefers certain types of these bands over others. With practice, you should become very proficient in having the preferred band on the appropriate retainer. Matrix bands are also shown in foldout 10.

Wedges. Wedges are small tapering, triangular pieces of wood about 1/2 inch in length. Since the general shape of tooth crowns vary, the band around the tooth may not always produce a snug fit. This leaves space through which condensed amalgam can pushout to create an undesirable overhanging restoration. The dental officer uses wedges to force the matrix band tightly against irregular tooth surfaces to prevent these spaces. This snugly fitting band then restricts the firmly condensed amalgam to the confines of the prepared cavity margins and the band itself. A dentist will sometimes use a matrix contouring instrument #FP 2A to place the matrix. This instrument is particularly useful for shaping the matrix during amalgam pin reinforcement procedures. (See FO 10.) Other matrices which the dental officer uses are called strips.

Matrix Strips. Matrix strips come in roll form, both in plastic and metal. The plastic type, commonly known as celluloid strips, is clear polyethylene in a 45-foot roll. There are three kinds of metal strips: copper (20-foot roll), copper-nickel alloy (10-foot roll), and stainless steel (20-foot roll). The dental officer uses the plastic as a matrix for silicate and resin filling materials and the metal as the base material for a special matrix band. At times, the standard packaged matrix bands do not provide the necessary length, width, or shape for a particular cavity preparation. When this is the case, the dental officer can cut the metal matrix strips to form the needed band. Another type of matrix is available in crown form.

Matrix Crowns. Temporary matrix crowns are made of either clear plastic or corrosion-resistant steel. They have three uses: (1) to hold temporary or sedative filling materials in place, (2) to hold badly broken down or fractured teeth in place, or (3) to serve as temporary crows while the dental laboratory is preparing permanent crowns. The clear plastic matrix crowns come in the incisor, cuspid, and bicuspid shapes. These crowns may be removed when the restorative material sets, or they may be left in place to lend additional strength. Corrosion-resistant steel crowns come in the incisor, cuspid, bicuspid, and molar shapes. Because of their poor esthetic quality in anterior regions, they are primarily used on posterior teeth. There are other matrices used less frequently than those we have already mentioned. We will group them as "other matrices."

Other Matrices. These are the cervical types. Cervical (neck) matrices are made of plastic and come in assorted sizes. The dentist uses cervical matrices to hold restorative materials firmly in place on the facial necks of anterior teeth.

Exercises (442):

Indicate whether the following statements concerning matrices are true or false by placing a T or F in the blank provided. Explain any false answers.

______1. The item used to force the matrix band tightly against irregular tooth surfaces is called a wedge.

______2. The #1 matrix retainer should be used when the tooth must be completely encircled.

______3. Plastic matrix crowns come in the incisor, cuspid, bicuspid, and molor shapes.

______4. Corrosion-resistant steel matrix crowns are primarily used on anterior teeth.

______5. Plastic strip matrix material is usually used as a matrix for silicate or resin restorative material.

______6. Tofflemire matrix retainers should not be heat treated.

3-7. Amalgam Instruments

While many instruments are used in restoring tooth structure, certain instruments are used specifically to amalgam restorative material. Amalgam instruments are those that carry, condense, carve, and finish amalgam restorations. Study foldouts 10 and 11 in the supplement as we cover this instrument group.

443. Identify amalgam instruments by their use and by their visible features.

Carriers. Amalgam carriers transport the freshly prepared amalgam restorative material to the cavity preparation. These carriers have hollow working ends, called barrels, into which the amalgam is packed for transportation. Both regular and large barrel carriers are available. When the lever located on the top of the carrier is depressed, the amalgam is ejected into the cavity preparation. Normally, two or more carriers are used during the amalgam placement procedures. This saves time for the dentist who is ejecting or condensing a carrier load while you are refilling the carriers.

Condensers. Amalgam condensers are instruments used to condense the amalgam filling materials into the cavity preparation. They are often called pluggers. The hammerlike working end is large enough to compress the soft amalgam without sinking into it. They come in single- and double-ended designs. Condensers also have variously shaped and sized working ends. They may be smooth or serrated. Normally, the dental officer favors certain condensers, which are used routinely. You should be aware of the dental officer's preference and have the preferred condenser available at the start of the condensing procedure. The condensers available through Air Force supply channels are listed below and are pictured in foldout 11.

Single – ended condensers
Black #1, #2, #3, 4, and #5

Double – ended condensors
Sweeney #1, #2, #3, #4, #5, #6, and 7
Tanner #OT, #2T, #3T, and #4T
Modified Mortonson #2

Carvers. After the amalgam in condensed, it must then be carved to approximate the original tooth structure. Carvers come in an assortment of shapes and sizes and in single- or double-ended designs. They have sharp cutting edges and are used to shape, form, or cut tooth anatomy into amalgam restoration. Some carvers also may be used to carve wax patterns for crown and inlay fabrication. As with condensers, dental officers also have favorite carvers which they use routinely. You must know the dental officer's preference so that you can have the desired instrument ready when it is needed. The carvers available through Air Force supply channels are listed below (FO 11).

Double – ended amalgam carvers
Cleoid, Discoid #89 – 92
Hollenback #1/2
#14 or "H"
Tanner #5T

Double – ended amalgam and wax carvers
Hollenback #1, #2, and #3
Walls #3

Burnishers. When the carving has been completed, a dentist may use burnishers to smooth and polish the restoration and to remove scratches left on the amalgam surface by the carving instruments. Burnishers have smooth rounded working ends and come in single- and double-ended types. These burnishers are listed below and pictured in foldout 11:

Single – ended burnishers
Ovoid, large #28
Ovoid, medium #29
Round, large #25
Round, small #27

Double – ended burnishers
#15 or "J"

Pin Amalgam Set. Extensive decay or a cusp fracture results in the loss of a major portion of the tooth structure. To restore such a tooth to its former healthy condition, the dental officer may choose to rebuild the tooth. If the tooth is a posterior one, the dental officer may use the pin amalgam technique. For a pin amalgam, the dentist uses specific instruments. Many times these pin amalgam instruments are kept together as a set (FO 12), which includes pinhole drills, pin drivers, pins, and perhaps grooved or threaded wire. The set available in the *Federal Supply Catalog* includes drills of two different lengths, pins of two different lengths, and one package of grooved wire.

Pinhole drills. The dentist uses the pinhole drills to drill holes in the dentin portion of the tooth to receive pins or wire of appropriate size. The pinhole drills closely resemble dental burs and are made for use in conventional speed handpieces. The actual drilling parts of these drills vary from .021 inch to .027 inch in diameter. They come in lengths of either 55/64 inch or 1 ⅝ inches. The shorter drills are used in contra-angle handpieces on posterior teeth. The longer drills are used in straight handpieces on anterior teeth.

Pins. The pins used in the pin amalgam technique are very small. Some are less than 1/4 inch long and .011 inch in diameter. These pins are available in grooved and threaded forms. The grooved type actually locks in place in the tooth dentin by friction, with the spiral grooves providing retention for the amalgam restorative material. The threaded type is screwed into place or cemented with zinc phosphate cement. The threads on this type of pin also help retain the restorative material. Each type comes in different lengths and diameters. Although pins generally are used in amalgam restorations, they also may be used to reinforce other restorative materials.

Wire. Although designed specifically for the same purpose as the precut pins above, some retention material is in wire form. Like the pins, retention wire comes also in grooved or threaded forms. Most of these wires are made of a corrosion-resistant steel and are in 4¾- and 6-inch lengths. Also, like the pins, different diameters are available. One advantage of the grooved retention wire is that you can cut it at the precise length needed. This feature is particularly helpful when the precut pin lengths would be either too short or too long. The pin length can be critical in the success or failure of large pin amalgams.

Condensers. Because of the difficulty experienced in condensing amalgam around pins, there are now special condensers for this purpose. These are the double-ended Markley #1, #2, #3, #4, and #5 condensers. Their function is the same as that of the amalgam condensers previously covered. They do, however, have much narrower working ends.

Exercises (443):

1. Answer exercises a through d by placing the identification letter or letters of the instruments pictured in foldout 18, exercise 443, in the spaces provided.

_____ a. Which letters identify instruments used to condense amalgam?
_____ b. Which letters identify instruments that are used to carve anatomy into amalgam restorations?
_____ c. Which letters identify instruments used to remove scratches left on the surface of an amalgam by carving instruments?
_____ d. Which letter identifies the instrument that is used to transport freshly mixed amalgam to the cavity preparation?

2. Identify the instruments listed below by placing the identification letter from foldout 18, exercise 443, in the space provided:

_____ a. Ovoid large burnisher.
_____ b. Tanner condenser.
_____ c. #15 or "j" burnisher.
_____ d. Amalgam carrier.
_____ e. Cleoid, discoid carver.
_____ f. Hollenback #3, carver.
_____ g. Modified Mortonson.

3-8. Resin and Cement Instruments

This instrument group consists of the instruments for mixing and handling restorative resin, silicate cement, and various temporary restorative, insulating, and pulp-capping materials.

444. State the purpose and characteristics of instruments used to mix and handle the resin and cement materials.

Spatulas. There are three different spatulas available for mixing restorative materials. (See FO 12). Some of these spatulas can cause discoloration in the material being mixed. The selection of a mixing spatula is not critical except when preparing a permanent anterior restoration. Site composite restoration material discolors easily, use the spatulas provided by the manufacture when working with it. The double-ended #142 plastic spatula and the single-ended #313 and #324 are suitable for mixing materials other than composites. The #313 spatula is a smaller version of the #324 and is used for mixing small quantities of cement. Thoroughly clean and disinfect the spatulas after each use.

Plastic Filling Pluggers. A variety of double-ended instruments make up this instrument group. They are used to transport and place dental cements, resin, and temporary, insulating, and pulp-capping materials. The working ends on plastic filling pluggers range from varying small cylinders to assorted angled, paddlelike shapes. These instruments are listed below and are pictured in foldout 12. All of these instruments are made of corrosion-resistant steel, except for #5—7, which are made of chromium alloy. The chromium alloy instruments are more suitable for handling restorative resins. Since these instruments are used in the mouth, they should be sterilized after each use.

Single – ended plastic filling pluggers
Gregg #1, #2, and #3
Double – ended plastic filling pluggers
Landmore #3

#1—2
#5—7
Woodson #1, #2, and #3

Exercises (444):

1. Which spatula should you use to mix silicate cement? Why?

2. How does the #313 spatula differ from the #324 spatula?

3. What should you do with a spatula after it has been used?

4. What is the purpose of plastic filling pluggers?

5. Which plastic filling pluggers are made of chromium alloy?

3-9. Surgical Instruments

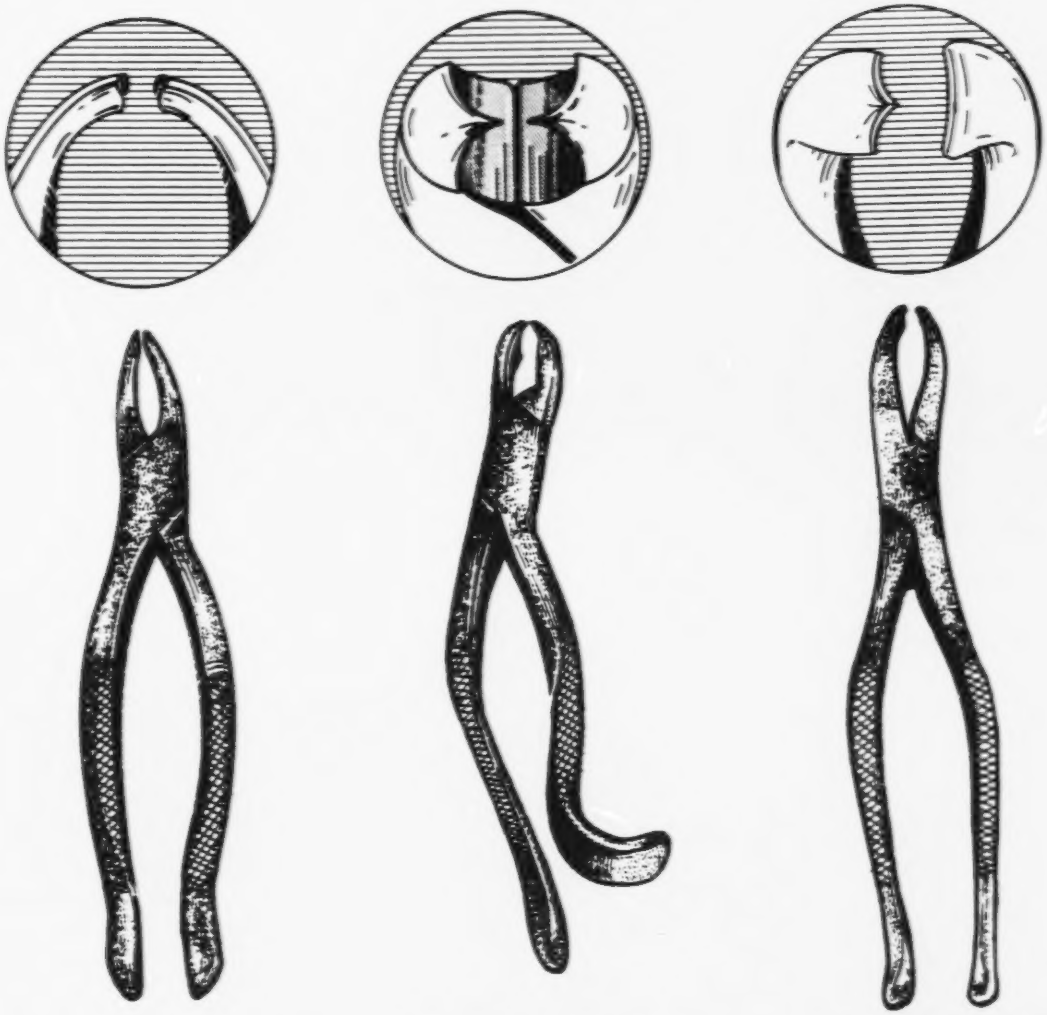
The instruments used to remove teeth or to treat the oral conditions that require cutting and bone removal are called oral surgery instruments. These instruments are made of high-grade steel, either stainless or chrome plated. Each instrument has a particular purpose and should be handled with extreme care. The instruments with cutting edges must be kept sharp to prevent slippage. Hinged instruments should be lubricated to keep them in good operating condition and to prevent rust. Although some 80 oral surgery instruments are available through supply channels, these instruments can be separated into groups for easy reference. Keep in mind, as we cover these groups, that most surgical procedures require several different instruments. Our coverage of surgical instruments begins with the tooth-extracting and miscellaneous forceps group.

With the exception of the rongeur forceps, which are used to cut bone, most forceps are grasping-type instruments. They are used to grasp teeth for extraction, secure patient drapes, hold suture needles, grasp oral soft tissues, transfer instruments and dressing materials, and control hemorrhage. The bulk of the forceps group is composed of those used for extracting teeth. (See FO 13.)

445. Identify the tooth extraction forceps used in the oral surgery section.

Tooth-Extracting Forceps. There are several types of tooth-extracting forceps; but except for those made for some specific operation, they generally have the same features: beaks, a neck and a handle. The beaks of tooth-extracting forceps are designed to grasp the tooth with maximum contact on the facial-lingual surfaces of the root(s) just below the cervix. The inner surface of each of the two beaks is concave and the outer surface is convex. Tooth-extracting forceps are designed for use in specific areas of the mouth. The beak is always shaped to conform snugly to the contour of the tooth. For example, both beaks of maxillary forceps are usually angled away from the curvature of the handles. These varying angles make it easier to reach various parts of the arch. The beaks of mandibular forceps are usually at a much sharper angle and in the same direction as the curvature of the handles. This makes it easier to reach different parts of the lower arch. The notches on the beaks serve as a guide to the region of the mouth where that particular forceps is to be used.

To identify the forceps, picture to yourself the number of roots on the tooth to be removed. All anterior teeth have single roots and need forceps with a single curve on the end of each beak. If you examine the tops of anterior forceps "head on," you will find that they resemble a set of parentheses, as illustrated in figure 3-2. Forceps for removing bicuspids are similar to those for anterior teeth. But they are generally wider than those used for anterior teeth. When you remember that lower molars have two roots, situated mesially and distally, you can easily see that any instrument designed to follow the curve of the root of the lower molars must be notched. The beaks of lower molar forceps are notched and, when examined head on, resemble two sets of parentheses arranged in the manner



Anterior Arrangement

Mandibular Posterior Arrangement

Maxillary Posterior Arrangement

Figure 3–2. Surgical extraction forceps.

shown in figure 3-2. The exception to this is the mandibular "cowhorn" forceps whose beaks resemble cowhorns. These beaks enter into the bifurcation facially and lingually to lift the tooth out of the socket.

Upper molar teeth have three roots—two facial and one lingual. To be effective on these teeth, the forceps must have a notched beak on the facial side and an unnotched beak on the lingual side (except for the 88 R and L, maxillary cowhorn forceps, which are just the opposite). You can see, then, why upper molar forceps are manufactured as right and left forceps. Some manufacturers stamp the letters R and L on the handle, but even without this identification it is easy to know which side of the mouth they are designed for if you remember the position of the notches in relation to the roots. By relating the parentheses to the upper molar forceps, you will find that, for the right and left sides, the parentheses are arranged to oppose each other. This arrangement is shown in figure 3-2.

Another way of identifying the general area of the mouth in which a tooth-extracting forceps should be used is by its neck. The neck is shaped so that the beak can be placed on the tooth and still be parallel with the long axis of the tooth. The handles are shaped so that a maximum amount of force can be applied to the beaks and the handles still be in a comfortable position for the oral surgeon. The beaks are also shaped so that a force on the handles tends to force the tooth out of its socket.

Since more than one forceps design is available for extracting any tooth, dentist naturally choose the one that is the most comfortable and gets the best results. So that you can better help the dental officers you work with, you need to know how to decide where a particular forcep is used. Let's examine the various tooth-extracting forceps in the Air Force inventory.

Tooth-extracting forceps #1. The #1 extracting forceps are used to remove maxillary anterior teeth, in particular maxillary cuspids. The beaks (grasping parts) are in line with the handle. Because of this straight line design, a dentist can exert much leverage with the #1 forceps.

Tooth-extracting forceps #150. The #150 forceps are sometimes referred to as the maxillary "universal" forceps. The beaks are set at an angle to the handles, which makes them accessible to any part of the maxillary arch. When the handles are closed, the beaks on the #150 forceps are noticeably close together at the tips and curve opposite each other to resemble parentheses. Notice also that the handles themselves have a slight curvature. Even though the #150 forceps can be used in any region of the maxillary arch, it is specifically designed to remove maxillary incisors, cuspids, bicuspids, and residual roots. There are also two modified types of #150 forceps. One is a scaled-down version (#150S) that is used in removing maxillary deciduous teeth. The other is the #150AS. This forceps has slightly thicker beaks with less curvature and more space between the beak tips when the handles are closed. Like the #150, the #150AS is used on the maxillary incisors, cupsids, and bicuspids.

Tooth-extracting forceps #65. The handles of the #65 forceps are straight and the beaks are offset. When the forceps are closed, they resemble a bayonet. The beaks are short, very narrow, and slender. The #65 forceps are used on maxillary anteriors, bicuspids, and root tips.

Tooth-extracting forceps #286. The tooth-extracting forceps #286 are very similar to forceps #65. The biggest differences are that the #286 beaks are wider and there is a wider space between the beaks nearest the handles when they are closed. These characteristics make the #286 a little more suitable than the #65 for removing maxillary bicuspids. The #286 also is used to remove maxillary anterior teeth and residual roots.

Tooth-extracting forceps #53L and #53R. The #53L and #53R forceps are used to extract maxillary first and second molars. The letters L and R indicate that the forceps are used on the left and right sides of the maxillary arch. They have straight handles with offset bayonet-type beaks. If you view the #53L forceps with the handles toward you, you'll notice a point on the right beak tip; the left beak tip is rounded. The opposite is true on the #53R forceps. As you remember from your study of dental anatomy in Volume 2, maxillary first and second molars have three roots. Two of these three roots are toward the facial surface, while the other is a single lingual root. Thus, the right beak of the #53L forceps engages the maxillary left first or second molar crown and enters between the two facial roots, while the concave left beak engages the lingual part of the crown and root. The exact opposite is true with the #53R forceps and the maxillary right first or second molar. This design lets the dental officer grasp the tooth securely for the rocking and elevating movements.

Tooth-extracting forceps #88L and #88R. The #88L and #88R forceps are often called maxillary cowhorns. Like the #53L and #53R, they are used on the maxillary first and second molars. They differ slightly from the #53L and #53R in the way they remove a tooth. The primary use of the #53L and #53R forceps is to grasp the crown and root portion of a tooth so that the dentist can rock the tooth from its socket. The #88L and #88R forceps operate on a wedging principle. They are inserted between the tooth roots and the surrounding bone. This wedging action lifts the tooth from its socket. The #88L forceps have a long, slender pointed right beak and a forked or deeply notched left beak for grasping the root structures on maxillary left first and second molars. The exact opposite applies for the #88R forceps and maxillary right first and second molars. The #88L and #88R forceps have straight handles.

Tooth-extracting forceps #210. The #210 forceps are used to pull maxillary third molars. The short beaks on these forceps have smooth rounded tips and wide concave inner surfaces. When these forceps are held in the operating position, the end of the left handle is noticeably curled to form a finger rest. These characteristics make the #210 different from the other maxillary molar forceps. The wide inner concave surfaces on the short beaks make the #210 particularly effective in grasping the generally underdeveloped maxillary third molar crowns. The #210S forceps have a slightly wider beak than the #210, and there isn't a finger rest curl. It also is used to extract maxillary third molars.

Tooth-extracting forceps #101. These forceps are used to remove maxillary and mandibular cuspids, bicuspids, and any remaining roots.

Hawkbill-type forceps. There are three hawkbill-type forceps: the Mead #MD3, the #13, and the #22. Their beaks are perpendicular to the working action of the handles. This design gives the dentist a great deal of leverage with minimum effort. The major physical difference between these forceps is the width of their beaks. This, as you may have guessed, is because they are used to pull different teeth. The Mead #MD3 forceps are used on mandibular anteriors and bicuspids; the #13 forceps on mandibular first and second bicuspids; and the #22 forceps on mandibular first, second, and third molars.

Tooth-extracting forceps #151. The #151 extracting forceps are similar to the #150 forceps, except the beaks are set at an angle opposite to the slightly curved handles. Another similarity between these forceps is that as the #150 is known as the maxillary universal forceps, the #151 is known as the mandibular universal forceps. The #151 is used primarily to extract mandibular anteriors, bicuspids, and roots. There is still a third similarity between the #150 and #151 forceps. Each has two additional versions to the basic forceps. The #151AS is smaller and is used to pull mandibular deciduous teeth. The #151A has slightly thicker beaks, with more space between them than between the beaks of the basic #151 forceps. The #151A is used in the same way as the #151 forceps.

Tooth-extracting forceps #203. The #203 forceps are used on mandibular anterior, bicuspids, and roots. These forceps are like the #101, except the beaks are more sharply angled from the handles. Like the #101 handles, the #203 handles are straight.

Tooth-extracting forceps #15. Forceps #15 are used to remove mandibular first and second molars. The beaks on these forceps have concave inner surfaces with pointed projections on the tips. These work well in grasping the crown with the two projecting tips extending to the bifurcation between the two roots on mandibular third molars. The left handle on the #15 has a finger rest.

Tooth-extracting forceps #16. The #16 forceps are nicknamed "mandibular cowhorns," because the beaks actually resemble cowhorns. This is especially true when the beaks are open. The #16 forceps are used to remove mandibular molars. The long, slender, curved beaks function on the same principle as the #88L and #88R forceps. The #16 forceps wedges between the tooth roots and the surrounding bone and, with pressure and a rocking motion, lifts the tooth from its socket. The left handle on the #16 forceps has a finger rest.

Tooth-extracting forceps #17. The beaks of the #17 forceps are similar to beaks of the #15 forceps. The handle of the #15 forceps is straight without a curled finger rest. Like the #15 and #16 forceps, it is used on lower first and second molars.

Tooth-extracting forceps #217. The #217 forceps are used primarily for removing mandibular third molars. The beaks have inner concave surfaces and pointed projections much like those of the #15 forceps. The handles, however, have a slight curvature and resemble those on the #151 forceps.

Tooth-extracting forceps #222. The beaks on the #222 forceps are rounded with concave inner surfaces, and angle sharply from the handle. Like the #217, it also is used to extract lower third molars.

Exercises (445):

1. Name the three parts of the extraction forceps.

2. How are the beaks of extraction forceps shaped?

3. When you are viewing lower molar forceps head on (with the exception of the mandibular cowhorns), what do their beaks resemble?

4. With the exception of the #88R and #88L forceps, what is the beak configuration of upper molar forceps?

5. How are the necks of extraction forceps shaped?

6. Foldout 19, exercise 445, shows several extraction forceps. Each is identified by a letter. Complete exercises a through k by placing the appropriate letter or letters in the space provided.

_____ a. Identify the three forceps that are designed exclusively for use in the maxillary arch.

_____ b. Identify the four forceps that are designed exclusively for use in the mandibular arch.

_____ c. Which forceps may be used to extract either maxillary or mandibular cuspids, bicuspids, or roots?

_____ d. Which forceps are referred to as the hawkbill forceps?

_____ e. Which forceps are referred to as a maxillary cowhorn forceps?

_____ f. Which forceps are referred to as the mandibular cowhorn forceps?

_____ g. Which forceps are used for extracting maxillary anteriors and in particular maxillary cuspids?

_____ h. Which forceps are used for extracting maxillary anteriors, bicuspids, and root tips?

_____ i. Which forceps are designed specifically for extracting a maxillary left first or second molar?

_____ j. Which forceps (other than the hawkbill type) are designed for extracting mandibular anteriors, biscupids, and roots?

_____ k. Which forceps (other than the cowhorns) are used for extracting mandibular molars?

446. Identify miscellaneous oral surgery forceps.

Miscellaneous Forceps. As we mentioned earlier, not all forceps are used to extract teeth. For the purpose of our discussion, we're arbitrarily calling them miscellaneous forceps. Refer to FOs 13 and 14 as we take a closer look at each one.

Needle-holder forceps. The needle-holder forceps are used, as the name indicates, for holding needles during suturing procedures. The typical needle holder has two short, rather blunt, serrated beaks. At the end of the handles there is a graduated, notched-locking device that lets the oral surgeon lock the suture needle in the suturing position as if the needle were an extension of the needle holder. In turn, the operator can devote full attention to the suturing process and not be overly concerned about keeping grip on the needle.

Hemostatic forceps. Hemostatic forceps look very much like needle-holder forceps. The main difference is that the beaks of the hemostatic forceps are longer and more slender. They also have both curved and straight beaks, and there is a locking device on the handle to keep the beaks closed. These forceps are used in general surgery to control hemorrhage by clamping or constricting blood vessels. But in oral surgery, they are more commonly used to remove bits of debris, such as bone chips or parts of teeth, from the oral cavity. Because of the extensive use of hemostatic forceps, you should have them ready for any procedure that involves the removal of teeth or bone.

Towel-clamp forceps. As the name implies, towel-clamp forceps are used to maintain surgical towels and drapes in the right position during an operation. The towel-clamp forceps have handles and a locking device similar to those on the needle-holder and hemostatic forceps. The working ends have sharp points that overlap in the closed position.

Gauze forceps. Gauze forceps are used to grasp sterile gauze sponges. They are long handled and have two ring-shaped beaks, which permit you to secure several gauze sponges at once. Gauze forceps are used when the aspirator is notable to handle all the blood in a patient's throat. When this occurs, you should be ready with sponges, locked in the gauze forceps, to absorb the blood at every opportunity. The gauze forceps are also used when the surgeon is performing multiple extractions under general anesthetic. The surgeon may soak several sponges (locked in the gauze forceps) with metaphen and swab the oral cavity for preoperative disinfection, or with epinephrine to staunch blood flow.

Surgical dressing forceps. The working ends on the surgical dressing forceps used in oral surgery are straight extensions of the handle. This instrument resembles large straight tweezers. Its inner surfaces are serrated. The forceps are used to transport gauze sponges, towels, and patient drapes. Using surgical dressing forceps to transport these items prevents contamination.

Tissue forceps. The tissue forceps, at first glance, appears to be a surgical dressing forceps with straight working ends. Upon closer examination of the working end, however, you notice a marked difference. One side of the working end has two very small, sharp-pointed extensions, which form a W-shape. The other side has a single, sharp-pointed extension that meshes in the middle of the opposing W-shape when the instrument is in the closed position. Although the tissue forceps are used in oral surgery to grasp and stabilize loose tissue ends during suturing procedures, they are mainly used to hold tissues being excised.

Instrument forceps. The instrument forceps are used to transfer instruments from surgical cabinets to surgical operating trays or to other areas as needed. The handles look like those on hemostatic forceps, but isn't a locking device. The working end can hold nearly any instrument securely, regardless of its shape. One side of the working end is a curved fork. The other side is a curved arm that meshes between the two opposing fork tines. Always store instrument forceps in an upright instrument forceps canister that has fresh disinfectant solution.

Exercises (446):

1. Match the statement in column B to the appropriate instrument in column A. Each statement should be used only once.

Column A	*Column B*
______ (1) Gauze forceps.	a. These forceps resemble large straight tweezers.
______ (2) Instrument forceps.	b. Used primarily in oral surgery to remove bone chips or other debris from the oral cavity.
______ (3) Tissue forceps.	c. These forceps have long straight handles with ring-shaped beaks.
______ (4) Hemostatic forceps.	d. These forceps have a locking device, and their beaks have sharp points that overlap when in the closed position.
______ (5) Dressing forceps.	e. One side of these forceps working end has small pointed extensions that form a W-shape.
______ (6) Needle-holder forceps.	f. One side of these forceps working is basically a curved fork.
	g. These forceps have short, blunt, serrated beaks that are used to hold a suture needle securely.

447. Describe the cutting instruments used in the oral surgery section by type, features, and purpose.

Cutting Instruments. When most people hear the word "surgery," the first thing they think about is the cutting of the body with knives. But knives are not the only cutting instruments used in surgery, particularly oral surgery. For instance, bone files, surgical scissors, and curettes also are used in some cutting functions. Refer to foldout 14 as we cover these instruments.

Surgical knives. The surgical knife handles and blades are used to incise or excise soft tissues and come in various sizes and shapes. The use of each type depends upon the type and accessibility of the tissue to be cut. Knife blades come in presterilized packages and should be discarded after one use. The reason is that a nicked blade will not make a clean incision and thus would delay the proper healing of the tissue. Attach and remove the blades from the knife handles with hemostatic forceps. This prevents accidental cuts and possible infection. The knives used in oral surgery are usually referred to as scapels or Bard-Parkers.

There are two commonly used surgical knife handles—the #3 and the #9. The #3 handle is short and wide. The #9 is fairly long and slightly thicker but narrower than the #3. The four blades used most often in oral surgery are #10, #11, #12, and #15.

Blades #10 and #15 have similar working ends. The greatest difference is that the #10 blade is larger. The cutting edge on both of the blades is on the curved part of the blade. Thus, they cut in either a straight or rocking fashion.

Blade #11 has a straight cutting edge and is used for lancing.

The #12 blade has a concave cutting edge, shaped like a hawkbill, and is used to rip the tissue.

Rongeur forceps. The rongeur forceps are used for trimming projecting, uneven, or overhanging bone (alveolectomy), usually after multiple extractions and before tissue suturing. Since these projections would be painful to someone wearing a denture, they must be trimmed. The rongeur forceps function is to snip off the bony projections. Some rongeur forceps cut on only one side. Others cut on the ends of the beaks. The cutting edges are sharp and should be examined for nicks after each use. Note that these forceps are similar in size and appearance to the tooth-extracting forceps, but each rongeur has a steel spring spreader, which opens the beaks when the pressure is released from the handles.

Bone file. Although most of the bony projections are removed with the rongeur forceps, some rough edges usually remain. The bone file is now used to further shape and smooth the alveolar bone. The Seldin #11 bone file is used in most Air Force dental clinics. It is a double-ended instrument, with both a large and a small working end.

Surgical scissors. Scissors are used in oral surgery to cut tissues and sutures. The scissors with saw-toothed cutting edges are used to trim excess or irregular soft tissues; those with smooth blades are normally used for cutting sutures or other fabric material. The surgical scissors listed in the *Federal Supply Catalog* include a smooth-blade, blunt-ended pair, and the angular, saw-toothed Dean scissors.

Surgical burs. Surgical burs are rotating cutting instruments used by many surgeons to remove bone or cut through teeth. They are made for both straight and contra-angle handpieces. The burs are shaped much like regular tooth cutting burs, but the blades of the surgical burs are farther apart so that they can cut hard tissue without burnishing it. They must be thoroughly scrubbed after each used to remove bone particles and blood from between the blades.

Surgical chisels. Surgical chisels also may be classified as cutting instruments. Like surgical burs, chisels are used to remove bone. They are also used to split teeth and are designed to be used with a mallet. Because their cutting edges are easily dulled, you must sharpen them after each use. The chisels used in oral surgery and listed in the *Federal Supply Catalog* are the Stout #1, #2, and #3. Surgical chisels are much larger than the enamel chisels used in restorative dentistry. The #1 Stout chisel has the widest blade, and the #3 has the narrowest.

Curettes. While surgical curettes are not strictly cutting instruments, they must do some cutting. Curettes are sharp, spoon-shaped instruments used to clean out infected cavities in bone and to remove debris from tooth sockets. They come in many sizes and in straight or angled shapes. The type used depends on the nature of the socket, curvature of the roots that were in the socket, and the location of the cavity. The curettes that's usually stocked in most dental clinics are the Molt #1, #2, and #4, which are straight curettes, and the Molt #5L, #6R, #9L, and #10R, which are paired, angled curettes.

Exercises (447):

1. What names are usually used for surgical knives?

2. What should you do with a surgical knife blade after it has been used?

3. Which surgical knife blade or blades have:
    a. A hawkbill shape?

    b. A curved cutting edge?

    c. A straight cutting edge?

4. Which cutting instrument function is to snip off bony projections?

5. What instruments is usually used after the rongeur forceps have been used?

6. Why are surgical chisels used?

7. Which surgical chisel has the widest blade?

8. What cutting instruments are used to clean out infected cavities in bone and to remove debris from tooth sockets?

448. Identify the elevators used in the oral surgery section by class and use.

Elevators. There are three types of elevators used in oral surgery: the malar, periosteal, and root (FO 15).

Malar elevator. As you recall, the facial bone that forms the cheek is called the zygoma or malar bone. An injury to this bone often causes a depressed fracture. If this occurs, the oral surgeon will use a malar elevator to raise the bone to its normal position.

Periosteal elevators. During oral surgery, the surgeon often needs to separate a bone and the fibrous membrane, called the periosteum, that covers it. This is done with a periosteal elevator. The surgeon also may use it to gain access to bone that needs trimming and to retained roots. The three periosteal elevators listed in the *Federal Supply Catalog* are the Molt #9, the Seldin #22, and the Seldin #23. The Molt #9 and the Seldin #22 are used exclusively as periosteal elevators, but the Seldin #23, because of its wide working ends, also is used as a retractor.

Root elevators. Root elevators come in many sizes and shapes. At least one and sometimes more are used in every tooth extraction. Which elevator or elevators are used depends upon the desire of the oral surgeon. Root elevators have three functions: to loosen the teeth in their sockets, to remove parts of teeth (broken root tips or retained roots), and sometimes to remove a complete tooth. In the last case, the tooth is usually an underdeveloped third molar. The elevators are actually levers. The fulcrum (support point) for the elevator is usually the tooth support bone.

The elevators composing the straight working end group are the #301 and the #34S. The working ends are in line with the handle and have a concave surface. The #301 has the smallest working end; the #34S has the largest.

There are two elevators with spade- or wedge-type working ends: the Stout A and the Cogswell A. The greatest difference between these two elevators is in the handles. The Cogswell A handle is grooved; the Stout A handle is plain.

The *Federal Supply Catalog* lists one pick-shaped root elevator, the Cogswell B, whose working end is shaped somewhat like a rounded toothpick tip.

In two sets of elevators, the handles are in line with the shank but the working ends are set at an angle. They are the Miller #73 and #74 set and the Seldin #1L and #1R set. The Miller #73 and #74 elevators have curved, thin, working ends with smooth, rounded tips. The Seldin #1L and #1R have very abrupt, sharp-tipped, working ends. The Seldins are sometimes referred to as East-West elevators.

One group of the elevators are used to remove fractured root tips lodged deep in the root socket. These elevators are often called root picks. Three elevators make up this group: the West #9, the West #9L, and the West #9R. The working ends on these elevators are very thin, sharply pointed, and small. The handles are also small in diameter but longer than those on other elevators we've discussed. The #9 has a straight working end and the working ends of the #9L and the #9R are set at left and right angles, respectively, to the handles.

Exercises (448):

Several elevators are pictured in foldout 19, exercise 448. Each is identified by a letter. Answer each of the following exercises by placing the appropriate letter or letters from this foldout in the space provided.

_____ 1. Which elevator belongs to a group called the root picks?

_____ 2. Select the two elevators that are classified as periosteal elevators?

_____ 3. Which elevator belongs to a set that is referred to as the East-West elevators?

_____ 4. Which elevator is classified as a straight elevator?

_____ 5. Which elevator would be used to elevate a depressed zygoma?

449. Describe the miscellaneous instruments used in the oral surgery section by features, type, and function.

Miscellaneous Surgical Instruments. In addition to the instruments we have covered, there are some others needed in the oral surgery section. Among these are the aspirating, irrigating, suturing, and retracting instruments, and the surgical mallets. Our coverage begins with aspirating instruments. Refer to foldout 15 as we cover these instruments.

Dental aspirator. The dental aspirator is not an instrument but an item of equipment. We mention it here because parts of the aspirator are considered as surgical instruments. These are the hose, handle, and tips. The hose used to connect the handle to the aspirator is latex rubber tubing and is usually from 30 to 36 inches in length. The handle has a bulbous portion on one end and a chunk on the other end. The bulbous portion is slipped into one end of the hose, and the chunk end holds the tips. There are two tips available—#2 and #4. The #2 tip is smaller and is suitable for use in a tooth socket. When these parts are properly joined and the loose end of the hose is connected to the aspirator, they function as a single suction unit. Your job is to connect the parts, operate the aspirator, and manipulate the handle and tip. With experience, you should be able to perform these tasks quickly and efficently to keep the surgical site clear for the oral surgeon.

Irrigating syringes. There are two types of syringes for irrigating the oral cavity. One is the bulb-type syringe. It is a rubber bulb with a small tube extension and a metal tip, which fits into the tube on the bulb. The other syringe (Luer type) is composed of a glass barrel and a glass piston. The barrel portion is fully open at one end with a constricted opening at the other end. The glass position has a handle on one end, while the remaining part acts as a plunger in the barrel. Irrigating syringes are used to flush pus and debris from tooth sockets and bone cavities and from under inflamed gingival flaps (pericoronitis). They also are used to direct sterile water onto a surgical bur to flush bone chips and blood from the dentist's field of vision.

Surgical mallets. The oral surgery mallet resembles a gavel. It is used along with a selected chisel to split teeth or reduce alveolar bone.

Suture needles. Most suture needles used by oral surgeons are semicircular. They have either smooth sides or cutting sides, and vary greatly as to the diameter of the semicircle. The smaller sizes are used most often because of the limited space in the oral cavity. Some needles are already attached to the sutures and come in sterile vials or foil packets. Other are available separately.

Suture materials. Suture materials are usually classed as either absorable or nonabsorbable. Almost all sutures used in oral surgery are nonabsorbable. Absorbable sutures are dissolved and absorbed in the body. Examples of absorbable sutures are the "catgut" (made from sheep's intestine) and "tendon" types. Many materials are used to make nonabsorbable sutures. Some of these are silk, cotton, nylon, and even corrosion-resistant steel wire. Probably the most common suture used in oral surgery is made of silk. All of these sutures are available in different diameters. The oral surgeon uses the suture material with a suture needle to close wounds in the oral cavity. Since almost all of the suture material is nonabsorbable, these sutures must be removed after the wound heals enough to hold together.

Tissue retractors. As the name implies, tissue retractors are used to retract tissue. In oral surgery they are used to hold tissue flaps away from the operative site to provide better visibility. These retractors have forklike prongs, which permit handling the tissue without causing excessive damage.

Exercises (449):

1. Which of the two aspirator tips is the larger?

2. Name the two types of irrigating syringes?

3. What surgical instruments are used to flush pus and debris from tooth sockets and bone cavities, or from under inflamed gingival flaps, and also are used to direct sterile water onto a surgical bur during tooth-sectioning procedures?

4. What surgical instrument is often used with surgical chisels to split teeth or reduce alveolar bone?

5. What is the usual shape of the surgical needles used in oral surgery?

6. Give the most common type of oral surgery suture material.

7. Describe the working end of a tissue retractor.

3-10. Periodontal Instruments

Periodontal instruments are used to treat the structures surrounding the teeth. You may remember from your study of the preceding volume that the greatest cause of tooth loss is periodontal disease. The periodontal instrument group includes scalers, files, curettes, probes, hoes, pocket-marking forceps, and knives.

450. Identify by features, type, and function the scaling instruments used to prevent or treat periodontal disease.

Scalers. A common practice of medical doctors and dentists is to follow a pattern when treating a patient. First, they check a patient's signs and symptoms and make a diagnosis. Only after they have a firm diagnosis, do they begin treatment. One of the first steps in any treatment is to remove the irritant that causes the disease or condition. A common source or irritation to periodontal structures is calculus. Calculus is a hard, calcified substance composed of calcium carbonate, calcium phosphate, and organic matter. This calculus is found on the exposed crown parts of teeth and often extends beneath the gingival tissues. The texture of calculus is generally rough. Scalers are used to remove calculus found on the crown portions of the teeth. Refer to foldouts 15 and 16 as we cover scalers and the ultrasonic handpiece set.

The U-15-33. This is the most common scaler used in the prophylaxis section. It is a double-ended scaler with one end shaped like a sickle. The other end is a short-pointed blade. Each end has a double cutting edge. The U-15-33 is used primary in anterior teeth areas on the facial, lingual, and interproximal surfaces.

Ultrasonic handpiece inserts. The ultrasonic handpiece inserts are used with the ultrasonic prophylaxis unit, which converts electrical energy into sound waves. There are three essential parts involved: the unit, the handpiece, and the handpiece insert. The unit transmits electrical energy to the handpiece. The handpiece insert then converts the electrical energy into sound waves or vibrations at the insert tip. These vibrations move the insert tips 1/1000 inch. When properly tuned, the tip vibrates from 20,000 to 25,000 times per minute. The vibrating tip action is very effective in removing calculus. To keep the tip from overheating, a small steam of water continually flows onto the tip. You must adjust the water so that the tip emits a fine mist (with a few droplets). There are eight different handpiece inserts listed in the *Federal Supply Catalog*. They are the curette type, the flat-hoe chisel type, the left hatchet type, the right hatchet type, and left Jaquette type, the right Jaquette type, the small, universal hook type, and the straight scaler type.

Exercises (450):

1. Where are scalers designed to be used?

2. Which main scaler is used most often in the prophylaxis section?

3. How far does the insert tip move during vibration?

4. What is the purpose of the handpiece concerning to electrical energy and sound waves?

451. Identify by class the instruments used in treating subgingival periodontal conditions.

Periodontal Curettes. We have already described one type of curette, the surgical type. Surgical curettes and periodontal curettes are similar in name only. Periodontal curettes are different in size and shape and are designed for different purposes. Periodontal curettes are more closely related to scalers than to any other instrument. They are, in fact, used to remove calculus just as scalers are; the main difference between the scalers and the curettes is the areas in which they are used. While scalers are used to remove calculus mainly on the exposed crown parts of the teeth, the periodontal curettes are used primarily to remove deposits of subgingival (below the gingiva) calculus and the lining of gingival scalcus. A number of investigations have shown that periodontal curettes are less traumatic than scalers to the hard structures, cementum, and supporting structures of the teeth. The *Federal Supply Catalog* lists the Gracey and McCall curettes. The Graceys listed are #1 through #14. The McCalls listed are #13s through #14s and #17s through #18s. Some commonly used Gracey curettes are #3, #4, #11, and #12. See foldout 16 for Gracey and McCall curettes and the other periodontal instruments.

a. The Gracey #3 and #4 curettes are double-ended instruments. You use these curettes on anterior teeth.

b. The Gracey #11 and #12 are also double-ended instruments. Since #11 and #12 Graceys are designed for fine scaling in all areas of the mouth, they are called the universal curettes.

c. The McCall #13s through #14s is a double-ended curette. Use this instrument for scaling biscupid teeth.

d. The McCall #17s through #18s is a second double-ended curette, specially designed for scaling molar teeth.

Periodontal Hoes. Periodontal hoes are used to remove subgingival calculus. Their working ends have small projections, which form the cutting edges. The cutting edge appears to be perpendicular to the shank, but the cutting edge on the periodontal hoe is actually placed at somewhere close to a 45° angle from the shank of the instrument. There are four periodontal hoes listed in the *Federal Supply Catalog*—Orban types #5, #6, #7 and #8.

Periodontal Files. Periodontal files are used to smooth roughened root surfaces. There are four periodontal files in the Air Force inventory: the Orban numbers 9, 10, 11, and 12. The Orban files have flat, wide, rounded working ends. The Orban #9 and #10 are a set of paired periodontal files used to smooth bone and roughened cementum on mesial and distal root surfaces. The Orban #11 and #12 compose a set used on the facial and lingual root surfaces of posterior teeth.

Periodontal Probes. Periodontal probes are used to determine accurately the presence, depth, and form of periodontal pockets. An angled shank places the working end at about a 45° angle in relation to the handle. The thin, narrow working end is easily inserted to the depth of the periodontal pocket. These working ends are scored at millimeter intervals. The scored marks make it easy to determine the depth of the pocket. Some probes have a mark for every millimeter from 1 through 10. Others have a mark for every millimeter from 1 through 3, then marks for every 2 millimeters from 3 through 7, and finally marks for every millimeter from 7 through 10. The *Federal Supply Catalog* lists the Fox and Merritt "B" periodontal probes. Both of these probes have scored marks as in the description above. The Fox and Merritt "B" probes appear much alike, except that the Merritt "B" has a round working end while the Fox has a flat working end.

Periodontal Pocket-Marking Forceps. The periodontal pocket-marking forceps are listed in the *Federal Supply Catalog* as the Goldman-Fox #1, and the Goldman-Fox #2. At first glance, periodontal pocket-marking forceps appear to be dressing forceps. When you examine the working ends, however, you can see that one tip has a perpendicular blade projection. They are used to mark the depth of periodontal pockets so that the mark is visible on the exposed gingiva before periodontal surgery. The smooth tip is inserted between the tooth and gums to the bottom of the periodontal pocket, and the instrument ends are then closed. This causes the tip with the blade to perforate (penetrate) the gingival tissue. Several of these perforations provide the operator with a reference line for the excision of excess gingival tissue and the elimination of periodontal pockets. The final family of periodontal instruments is the periodontal knives.

Periodontal Knives. The periodontist used periodontal knives to remove gingival tissue (gingivectomy) during periodontal treatment. There are several knives manufactured for this purpose. They are the Kirkland #K-15; the Kirkland #16; and the Orban knives #19, #20, #21, and #22. The Kirkland knives are used to make the initial incisions, and the Orban knives are used to complete the removal procedure.

Exercises (451):

Foldout 19, exercise 451, shows several periodontal instruments. Each is identified by a letter. Complete each exercise by placing the appropriate letter(s) in the space provided.

_____ 1. Which instrument is designed to remove gingival tissue (gingivectomy)?

_____ 2. Which instrument perforates gingival tissues to provide a reference line for the excision of excess gingival tissue?

_____ 3. Identify the three instruments that are designed to remove subgingival calculus deposits.

_____ 4. Which instrument can accurately determine the presence, depth, and form of periodontal pockets?

_____ 5. Which instrument is used to smooth roughened cementum on root surfaces?

_____ 6. Which instrument is a periodontal hoe?

_____ 7. Which instrument is an Orban file?

_____ 8. Identify the two periodontal curettes.

_____ 9. Which instrument is a periodontal knife?

_____ 10. Which instrument is the pocket-marking forceps?

_____ 11. Which instrument is the periodontal probe?

3-11. Endodontic Instruments

If the pulp of a tooth is dead, the dentist must consider endodontic treatment. Endodontics is root canal therapy. It includes removing the tooth pulp, sterilizing the root canal, and filling the root canal with filling material. Endodontics is sometimes done with the surgical removal of the tooth root apex and the surrounding infectious debris; this procedure is called an apicoectomy. The instruments specifically designed for root canal procedures are called endodontic instruments. They include root canal broaches, reamers, files, and pluggers. Refer to foldout 16 as we cover these instruments.

452. Describe the instruments used for endodontic procedures by function, features, and type.

Root Canal Broaches. A root canal broach is usually one of the first instruments used in the pulp canal during endodontic treatment. Before broaches are used, however, the dental officer uses a bur to get into the pulp chamber. Broaches are then used to clear the canal of soft tissues. These broaches are shaped like needles covered with small barbed projections. The *Federal Supply Catalog* lists three sizes: coarse, fine, and extra fine. The usual procedure is to start with the smallest broach, and discard each broach after it has been used.

Root Canal Reamers. Root canal reamers are used to enlarge the pulp canal after the broaches have been used. The reamers are available with either short or long handles. They are also available in many sizes. The *Federal Supply Catalog* list begins with size 10 and continues in intervals of 5 to size 60. Beginning with size 60, they are also available in intervals of 10 through size 100. The working ends on reamers look like a needle with screwlike graduated threads. The dental officer may use several reamers in one operation. The dentist usually begins with a relatively small size, then uses the next larger size each time, until the canal has been reamed to the desired diameter.

Root Canal Files. Root canal files are used to smooth the root canal following the use of the reamers. The working ends of the files look much like those of the reamers. The difference is in the threaded part. The file threads are much finer and closer together. Like the reamers, the files come with either a long or a short handle and in the same sizes. Files also come in two other sets called the Hedstrom files. Both of the Hedstrom file sets, like the regular files and reamers, are in sizes beginning with size 15 and continuing through size 100. The difference between the two sets is in the length of their working ends. The working ends of one set are 21 mm long, and the ends of the other are 25 mm long.

Root Canal Pluggers. Root canal pluggers are used to pack root canal filling materials into prepared root canals. The working ends of these pluggers are cylinder shaped with flat tips. There are two different types available. One type has contra-angled working ends; the other has straight working ends. The contra-angled types are numbers 7, 9, and 11; number 7 is the smallest. Numbers 1, 3, and 5 make up the straight working end type. The contra-angled types are convenient for biscupid teeth, and the straight types are suitable for anterior teeth. Another instrument is the gutta-percha spreader #3. The spreader has a contra-angled point. There are also finger-type spreaders. This spreader acts much like the amalgam plugger, in that, it condense the gutta-percha inside the prepared root canal.

Endodontic Explorers. In addition to the other endodontic instruments, there are two explorers: the #DG16A and #16B. The endodontic exployers have long, narrow working ends, angled from their shank in such a way that they provide easy access to the pulp canal. The endodontic explorers are used for exploration and debridement of pulp chambers and canals.

Exercises (452):

1. Which endodontic instrument is used to clear the pulp canal of soft tissues?

2. Which endodontic instrument is used to enlarge the pulp canal?

3. What endodontic instrument is used, after the reamers, to smooth the root canal?

4. How do the threads of the files and the reamers differ?

5. Describe the two types of root canal pluggers.

3-12. Prosthodontic Instruments

A prosthodontic appliance is a replacement for a missing portion of the normal dentition. Full dentures, removable partial dentures, fixed partial dentures (bridges), and crowns are prosthodontic appliances. There are many instruments used in prosthodontic treatment. Some are used only in the dental laboratory. Others are used only in the prosthodontic treatment room. Still others are used in both places. You are primarily concerned with those used in the treatment room. This group includes impression trays, spatulas, mixing bowls, knives, pliers, scissors, the alcohol torch, the crown remover, and the roach carver. Refer to foldout 17 as we cover these instruments.

453. State the functions and features of instruments used in the prosthodontic section.

Impression Trays. Impression trays hold impression materials in place while it sets or becomes elastic. The impression may include a portion of the arch or the entire arch. Generally, the impression tray is shaped to match the natural contour of the arch. These trays come in many sizes for both the maxillary and mandibular arches. The tray used to make mandibular impressions differs from the maxillary tray because it allows free tongue movement. Impression trays are made of either aluminum or brass.

Aluminum impression trays. The aluminum impression tray group is used for making edentulous (without teeth) arch impressions. (See FO 17.) You have two responsibilities with aluminum trays: to keep them clean and to learn the ones your dental officer prefers.

Brass impression trays. Brass impression trays do not appear to be made of brass, because they are plated with a nickel-colored metal. These trays are easily identified, however, by their rimlocking characteristic. This rim resembles a metal wire soldered along the inner part of the tray at the edge of the outer borders. Also, the maxillary brass impression tray has a U-shaped wire soldered to a palatal area of the tray. These trays are called rimlocking impression trays. Semiliquid impression material flows into the undercuts (ledges) formed by the rim and sets (hardens). This locks the material in the tray. The dental officer can then remove the impression without fear of separating the impression material from the tray. Rimlocking trays are used for hydrocolloid impression materials.

Prosthodontic Spatulas. Spatulas are used in prosthodontics for handling dental waxes and mixing impression materials. The spatula used to mix the various impression materials is called a laboratory spatula. It has a 2½-inch flexible blade, which is about 1 inch wide with a rounded end. The handle is usually made of wood or plastic. The wax spatulas commonly used are the Beale #7 and the Gritman #31. The #7 spatula is much shorter and has small, spoon-shaped double working ends for detailed wax work. The #31 spatula is also double-ended with one large rounded, spoon-shaped end and one large sharp-pointed, spoon-shaped end. Spatula #31 is used on the less delicate wax work where detail is not a requirement. Both wax spatulas are used to hold small bits of wax over a Bunsen burner flame. Once the wax melts, it may then be poured onto an occlusion rim or added to a wax denture base. At times, wax spatulas are heated over a flame and used to smooth or adjust wax patterns, occlusion rims, and baseplates.

Mixing Bowl. This bowl is made of a flexible material, either rubber or flexible plastic, and is used to hold alginate-type impression material and water for mixing. It comes in small, medium, large, and extra large sizes. All sizes are used in the dental laboratory, but the one often used in the prosthodontic treatment room is the medium size. The spatula used to blend the powdered alginate and the water is normally the 2½-inch blade spatula we mentioned earlier. You also may find that a regular, dining-hall, table knife is used as a mixing spatula. In either case, the rounded ends on the spatula or the table knife match well the contour of the mixing bowl.

Prosthodontic Knives. Usually, two kinds of knives are used in the prosthodontic treatment room: the compound knife and the plaster knife. As the names imply, one is used with compound, and the other is used with plaster.

Compound knife. The compound knife has a fairly large, red plastic handle and detachable blades. Routinely, the #25 blade is used to trim impression compound, wax, and other materials that require an extremely sharp cutting edge. This blade is almost identical to a larger version of the #11 surgical blade we talked about earlier. Your primary concern with the compound knife is to replace broken or dull blades.

Plaster knife. The plaster knife is a heavy-duty model used to trim and chisel plaster of paris and impression compound. It has a large flat blade at one end with a wide screwdriver-appearing projection at the other end. The handle is made of wood and riveted in place. You must keep its blade sharpened.

Dental Pliers. Dental pliers have several functions. Those listed in the *Federal Supply Catalog* include the pin amalgam type, the matrix type, and several others designed for use in the prosthodontic section. Some of the more common ones found there are the clasp bending, contouring, and clasp adjusting types. This group generally includes, but is not limited to, pliers #47, #122, #134, #137, and #200. This group provides the prosthodontist with a variety of working jaw shapes for adjusting, bending, and contouring prosthodontic appliances. Once again, your responsibilities are to identify the pliers by function and to learn which pliers the dental officer prefers. If you do these things, you will have the desired instrument available when it is needed.

Collar and Crown Scissors. The primary use of the collar and crown scissors in the prosthodontic section is shaping copper bands. The same scissors are used in restorative dentistry to cut and contour matrix bands. Collar and crown scissors are listed in three different types: the straight universal, the Beebee curved, and the Quimby curved. All of these are heavy-duty scissors because they must cut the metal matrix bands and strips as well as copper bands. These scissors are fairly maintenance free. They measure from 4¼ to 4¾ inches in length.

Alcohol Blowtorch. The alcohol blowtorch provides directional control for an alcohol flame. Basically, it is a small alcohol burner (wick type) with a hand pump that operates bellows. The bellows forces air through a small air jet on top of the blowtorch. The air jet is set to direct the air across the flame. This design allows the prosthodontist to direct the flame in any direction. The alcohol blowtorch is frequently used to partially melt and smooth roughened wax on denture wax-ups and to soften baseplates for adapting to stone models. Your duties with the blowtorch are to keep it free of wax and to keep the fuel reservoir filled with the proper fuel.

The proper fuel for the alcohol blowtorch is, as the name indicates, alcohol. But, not just any alcohol will do. For example, dental clinics frequently use isopropyl alcohol as a disinfectant. Used as a disinfectant, isopropyl alcohol is in a solution, containing about 70 percent alcohol and 30 percent distilled water by volume. The diluted alcohol produces a flame of very poor quality. Further, 100 percent isopropyl alcohol tends to smoke badly while burning, which makes it somewhat undesirable as a blowtorch fuel. Ethyl alcohol produces a clear blue flame but is undesirable because it is a security item. Also, the denatured and rubbing alcohol types are unsuitable as fuels. The best fuel choice for the alcohol blowtorch is methyl (wood) alcohol. (NOTE: Methyl alcohol is highly poisonous if taken internally.) It burns with a reddish-yellow flame, which is not as hot as the ethyl alcohol flame, but is hot enough for use in the prosthodontic section.

Crown Remover. There are times when a dentist must remove a gold crown from a tooth. To do so, he or she must have a crown remover instrument. The handle on a crown remover is encircled with a heavy-steel weight that slides from one end of the handle to the other. Two interchangable points make up the working end. One of these points is contra-angled and the other is straight. Both points have a right angle projection at the top. When the crown remover is used properly, the tip is placed over the margin or junction of the crown and tooth first. Then the sliding weight on the handle is tapped against the bottom part of the handle.

Roach Carver. The roach carver is a double-ended instrument used to cut, smooth, and carve dental waxes. At first glance, it appears to be a wax spatula. A closer examination reveals a spear-shaped blade at one end, with a deep-welled, very small spoon at the other end. Both ends have very sharp edges.

Exercises (453):

1. Which type of impression tray is usually used for the impression of an edentulous arch?

2. Which prosthodontic knife has a fairly large, red plastic handle and uses detachable blades?

3. Which prosthodontic instrument has a heavy-steel weight that slides up and down its handle?

4. What is the best fuel choice for the alcohol blowtorch?

5. What double-ended prosthodontic instrument is used to cut, smooth, and carve dental waxes?

6. Which prosthodontic instrument is used for clasp bending, contouring, or adjusting?

7. Which prosthodontic spatulas are used with dental waxes?

8. In addition to a spatula, what other equipment item is required in mixing alginate-type impression material?

9. What prosthodontic item is used for the shaping of copper bands?

10. What is another name for the brass impression trays?

3-13. Sharpening Dental Instruments

Just as a pocketknife or a paring knife need sharpening from time to time, so do dental cutting instruments. If fact, this need is even more critical with dental cutting instruments. You may use a dull pocketknife to carve a piece of wood with little consequence. About the only difference in using a dull pocketknife or dull paring knife is that a dull knife makes the carving harder and takes more time. When dealing with dental instruments, however, the need is far more critical, because they are used on human beings. A sharp instrument makes the dental officer's work easier and lessons, by far, a patient's trauma.

454. Identify the procedures and equipment involved in sharpening dental hand instruments.

Since it is to important that dental instruments be sharp, you should test each one. Look at each instrument's cutting edge through a magnifying glass. (Use over-the-shoulder lighting.) A sharp edge shows as a fine line rather than a surface. Also, the sharp edge reflects no light. Another way is to slide the cutting edge over your fingernail. A dull instrument will not cut the nail and needs sharpening.

Care of the Sharpening Stones. Before sharpening instruments, coat the sharpening stone surface with a light machine oil. If you neglect this step, metal filings from the instruments will become embedded in the dry pores of the stone. This forms a glaze that makes the stone ineffective. Also, when you finish sharpening instruments, be sure to remove any oil film or metal filings, or the stone will absorb them and become glazed. If a stone becomes glazed, you can restore its abrasive surface by soaking it in an ammonia-water solution. If the stone is flat, restore its abrasive surface by rubbing it with a fine grade of emery cloth on a wooden block.

Sharpening stones are available in two types—the Arkansas stones and the carborundum stones. There are two styles of Arkansas stones. One is a flat 2- by 8-inch stone, and the other is a grooved stone. The grooved stone is particularly useful when sharpening instruments have curved or disc-shaped cutting edges. The carborundum stones are usually mandrel mounted for use with the conventional speed handpiece.

The hard Arkansas stone is an oilstone with a surface that permits free honing movements. If you look closely at the stone, you'll see that its surface is made up of tiny crystals. These crystals act as little, sharp cutting points. When you sharpen an instrument, you are actually recutting it into shape. The hard Arkansas stone is preferred for the following reasons:

(1) The point of the instrument may catch in the carborundum stone and ruin both instrument and stone.

(2) The surface of the Arkansas stone is not easily grooved and will remain an effective sharpener for a longer period of time.

To prevent uneven wear of the stone, use the sides as well as the middle to sharpen instruments. Draw the instrument over the stone with a long, firm stroke. Be sure to maintain the correct bevel of the instrument. Instruments used for cutting soft structures usually have long, thin bevels, and those used for cutting hard structures have short bevels. Always draw the instrument toward the bevel of the cutting edge. The cutting edge is produced when the instrument is drawn across the stone at an angle. The edge has length but no thickness.

Instrument Sharpening. Divide your dental cutting instruments into three groups for sharpening: those with flat, beveled working edges, those with curved working edges; and those with irregular working edges. In sharping dental instruments, make sure you restore the instrument cutting surface as nearly as possible to the original cutting edge. Inaccurate sharpening can ruin an instrument. In particular, make sure you keep the correct bevel or curvature. The instrument will cut much better if you do.

Sharpen instruments with flat, beveled working edges on a flat Arkansas stone. Place the blade on the stone at 45° angle. Pull the blade back and forth across the stone with a firm, even stroke until it is sharp.

You may sharpen some instruments with a curved working edge on a grooved Arkansas stone. The spoon excavators, elevators with spoon-shaped working edges, and some scalers are included in this group. The grooves in the stone are rounded and of different sizes. Be sure to use the groove of the proper size. To sharpen these instruments, place the working end in the proper and draw the instrument away from the cutting edge. When you check these instruments for sharpness, make sure that the curved working edge is smooth and perfectly shaped.

The final group of instruments to be covered are those with irregular working edges. The explorers, curettes, extraction forceps, some elevators, and most of the scalers are included in this group. Use the shape of the old cutting edge as your guide. To sharpen them, use mandrel-mounted stones. These stones come in various sizes to make it easier to reach the almost inaccessible areas of the cutting edge. You should select the size that fits the working edge of the instrument and place it in the handpiece. Then hold the instrument with the working edge toward you. Rotate the stone slowly in a clockwise direction. With practice, the task becomes much easier.

A fairly recent addition to the *Federal Supply Catalog* has made mandrel-mounted sharpening stones easier to use. This addition is called a dental instrument sharpening guide. It consists of a sheath, which fits a roundnose dental handpiece, and comes with it a mandrel-mounted sharpening stone. It also features a T-shaped dental instrument rest, an adjustable chuck for positioning this T-shaped rest, and a swiveling arm that connects the chuck to the sheath. This guide can be a tremendous aid to you in keeping irregular-surfaced instruments sharp. Since the

344

dentist depends upon you to keep all cutting instruments sharp, you need to take advantage of all available sharpening aids.

Exercises (454):

Place the letter "T" in front of the correct statements. Correct any false statements.

_____ 1. The sharp edge of an instrument will reflect light.

_____ 2. Before sharpening instruments, oil the surface of the Arkansas stone to prevent its pores from becoming embedded with metal filings.

_____ 3. You can restore the surface of a glazed Arkansas stone by soaking it in hydorgen peroxide.

_____ 4. When sharpening instruments on a flat Arkansas stone, you should always draw the instrument away from the bevel of the cutting edge.

_____ 5. Instruments with a curved working edge should be sharpened on a flat Arkansas stone.

_____ 6. Mandrel-mounted stones are effectively used to sharpen instruments with irregular working edges.

_____ 7. When sharpening instruments with a mandrel-mounted stone, you should run the handpiece slowly.

CHAPTER 4

Housekeeping and Equipment Maintenance

AN IMPORTANT part of your job is to provide a neat, clean, and safe environment for your patients and co-workers. In this chapter, we discuss how to provide such an environment by covering general housekeeping duties and dental equipment maintenance.

4-1. Housekeeping Duties

A clean work area is very important, because micro-organisms (bacteria) that flourish in a dirty environment can infect a patient. To prevent this, you need to clean the equipment and facility at prescribed intervals. By doing so, not only will you insure a sanitary environment, but will give your patients a good impression of the clinic.

455. Identify cleaning procedures for dental equipment.

Equipment Cleaning. The problem with improperly cleaned equipment is not that people in your field don't know how to clean it, but that they fail to do so. Too many dental assistants assume that because if the equipment looks clean, it is. Of course, this is an assumption we can't make, since micro-organisms are invisible to the naked eye. What we have to do is to make cleaning at prescribed intervals a habit and to accept cleanliness as an absolute *must* for our clinic.

Mostly, the cleaning of dental equipment involves cleaning chrome-plated, painted, stainless-steel, and upholstery surfaces. As a general rule, wipe these surfaces daily. Occassionally (at least twice weekly), wash them with a damp cloth and mild soap, and monthly apply a quality automobile paste wax to chrome-plated and painted surfaces and a metal polish to stainless-steel surfaces monthly. To clean upholstery surfaces, use lukewarm water and mild soap. Apply only a thin layer of suds to the surface with a sponge. Then, use a cloth dampened with clear water to remove the suds. To finish the job, dry the surface with a soft cloth. Always check the applicable service manual before attempting to remove stains or deposits from any equipment surface.

Exercises (455):

Enter a T or an F in the blank provided with each of the following statements to indicate whether the statement is true or false. Explain any false statements.

_____ 1. The problem of improperly cleaned equipment is not so much the problem of "how to clean it" as it is failure to carryout cleaning responsibilities.

_____ 2. The key to good dental equipment housekeeping is to make a habit of cleaning at prescribed intervals and to accept dental clinic cleanliness as an absolute must.

_____ 3. The cleaning of dental equipment involves only the cleaning and waxing of chrome and stainless-steel surfaces.

_____ 4. Metal polish is applied to stainless-steel surfaces monthly.

_____ 5. To clean upholstery surfaces, apply a quality automobile paste wax, then wash with a damp cloth and mild soap.

456. State facility cleaning procedures.

Facility Cleaning. You have two goals when cleaning a dental facility—keep dirt and filth at the lowest possible level and make the facility presentable. Fortunately, you're usually able to meet both requirements simultaneously. That is, when the facility is clean, it is usually presentable, and vice versa. Cleaning a dental facility involves cleaning its floors, walls, windows, furniture, plumbing fixtures, and light fixtures.

Floors. You will find a number of different floor coverings in health care facilities. In most Air Force dental facilities you'll find a combination of carpeting, asphalt or asbestos-vinyl tile, ceramic tile, and concrete surfaces. Normally, all of these floors require daily attention.

Maintain the carpeting in your clinic by vacuuming and spot removal. Vacuum all carpeting at the end of each duty day to remove dust and micro-organisms, and remove any unsightly spots by shampooing. If shampooing doesn't remove a spot, check with your NCOIC before using solvents.

The standard for an asphalt or asbestos-vinyl tile floor is to keep it polished and looking clean. To meet this standard, you must sweep, damp mop, and buff at least daily and wax periodically. If the floor is coated with a water emulsion wax, scrub it at least weekly. Scrubbing removes the soiled old wax and scuff marks before you add new wax. If the floor is covered with a resin-emulsion wax, you may wait for as long as 3 weeks or more before scrubbing and rewaxing. This wax is more resistant to soil and stains than the water-emulsion type. Do not use waxes containing inflammable solvents without first getting approval from the installation engineer.

Walls. Most walls in Air Force dental clinics are either painted, tiled, or covered with wood paneling. All of these surfaces collect dust and must be cleaned periodically. The exact interim between cleanings is determined by local conditions. To clean painted and wood-paneled walls, apply a mild soap solution sparingly and followup by rinsing with clear water. Clean acoustical tile walls by dusting them with a dry cloth or by vacuuming. Don't forget the doors, baseboards, and framework.

Windows. Another significant requirement in cleaning a dental facility is window cleaning. Most Air Force dental facilities have a large number of windows, which soon become "eyesores" because of neglect. Since a dental patient will often associate the cleanliness of a dental clinic with the cleanliness of the windows, we must do our utmost to keep all clinic areas clean.

Whenever possible, use clean water as a cleaning agent on window surfaces. Clean water is removed easier and streaks less than most commercial window cleaners. If water will not sufficiently clean a window, you may use a stock-listed window cleaner or add a small amount of ammonia to water. Apply these agents with a soft, clean cloth and dry the windows with a clean, dry, lint-free cloth. You can further reduce streaks by moving the drying cloth horizontally across the window.

Plumbing fixtures. In cleaning plumbing fixtures, you have to deal with two types of surfaces—chrome-plated and porcelain. Clean these surfaces daily to maintain their characteristics luster. Normally, you'll clean chrome-plated fixtures with a damp cloth and then polished them with a soft, dry cloth. If you must clean corroded, chrome-plated fixtures, use a soft cloth and apply stock-listed metal polish. Then use another soft, dry cloth to shine the fixture. Clean porcelain surfaces with scouring powder or porcelain cleaner liquid. Normally, scouring powder is the choice for cleaning porcelain sinks, while porcelain cleaner liquid is used for cleaning other procelain bathroom fixtures. Since porcelain cleaner is caustic, read the container's label to use the cleaner.

Lighting fixtures. Some Air Force dental clinics have light fixtures suspended from the ceiling. These fixtures because of their structure and location, are dust collectors and must be cleaned periodically (about once each quarter). Before cleaning these fixtures, make sure that the electrical switch is in the OFF position. Then dismantle the fixture as much as you can without using tools. The dismantling normally provides access to all areas of the fixture. Next, clean the fixture with a damp cloth.

CAUTION: Be sure that you do not apply the damp cloth to hot light bulbs or lamps because this might cause the bulb or lamp to shatter. When you're through reassemble the fixture.

Furnishings. The furnishings in Air Force dental clinics include pictures, window shades, drapes, tables, chairs, couches, and desks. As a general rule, you should dust these items with a soft, dry cloth daily. However, if dusting does not remove the soil and stain, you may need to use mild soap and water or shampoo. Milk soap and water are appropriate for cleaning painted and plastic surfaces. Use shampoo to clean fabric-type upholstery found on some chairs and couches. Have drapes dry-cleaned. Since most furnishings are in the waiting room for all to see, by keeping them clean you help the dental service put its best foot forward.

Exercises (456):

1. What two goals are usually met simultaneously in cleaning a dental facility?

2. How often do the variety of floor coverings used in most Air Force dental facilities normally require attention?

3. State briefly how to maintain carpeting.

4. How often should you scrub and rewax:
   a. Floors coated with water emulsion wax?

   b. Floors coated with resin-emulsion wax?

5. What determines the time between cleanings of Air Force dental clinic walls?

6. Although clean water is preferred as a cleaning agent on window surfaces, name two alternate ways to clean windows when water will not do the job.

7. How often should plumbing fixtures be cleaned so they will keep their characteristic luster?

8. What precautionary step should you take before dismantling dental clinic lighting fixtures to do periodic cleaning?

9. As a general rule, how and when are dental clinic furnishings dusted?

10. How are drapes cleaned?

457. Identify housekeeping procedures for areas outside the dental clinic.

Outside Areas. Among the outside dental clinic items that need attention are the building exterior, lawn, and parking lot. To maintain the building exterior in a presentable condition, you should keep the windows and entrance ways clean and keep cobwebs removed from the exterior. Maintaining the lawn means that you should keep the grass and hedges neatly trimmed, the walks and steps free of debris, and all litter picked up (particularly around trash receptacles). Normally, parking lot maintenance means keeping the lot free of litter.

Exercises (457):

Indicate which of the following statements are true and which are false by inserting a T or an F in the blanks provided. Explain any false answers.

_____ 1. Among the outside dental clinic items that need attention are the building exterior, lawn, and parking lot.

_____ 2. Keep the windows and entrance ways clean and keep cobwebs removed from the building exterior.

_____ 3. Maintaining the lawn, parking lot, and area around trash receptacles includes picking up litter.

4-2. Maintenance of Dental Treatment Room Equipment

Two men bought identical houses next door to each other. At the end of a year, each sold his house and moved from the city. One man received $5,000 more than the other for his house. The man who received the most had routinely made minor repairs and adjustments. The other made none. From this example, you can see the importance of doing necessary maintenance. This section covers the principles of maintenance of dental treatment room equipment and some specific maintenance functions that you should perform.

458. Identify the scope of responsibility for each type of maintenance.

Types of Maintenance. Each medical organization is responsible for the maintenance of the equipment it uses. To help you understand your responsibility in this area, we will discuss four types of maintenance: preventive maintenance, organizational maintenance, field maintenance, and area maintenance.

Preventive maintenance. This is the care and servicing of equipment so that it remains serviceable. It includes proper operation and use, systematic inspection, detection, and correction of incipient failures—either before they occur or before they develop into major defects. Doing preventive maintenance is the responsibility of both the medical equipment repairer and the user. It insures maximum reliability, prolongs the useful life of the item, and reduces the time that the equipment is inoperative. Preventive maintenance includes the following routine operational checks: maintenance of oil levels, simple lubrication, daily inspections, cleaning, and minor exterior repairs. As a dental specialist, preventive maintenance is your responsibility.

Organizational maintenance. This type of maintenance is done by the using organization. It consists of inspecting, servicing, lubricating, adjusting, repairing, modifying, and replacing parts or assemblies and subassemblies. Organizational maintenance requires the services of qualified maintenance personnel and the use of tools and test equipment not available to the operator of the equipment. It should be done only by, or under the direct supervision of, a fully qualified medical equipment repairer.

Field maintenance. This is maintenance done by a designated maintenance activity in support of using organizations. This maintenance is normally limited to major repairs, inspections, and replacement of parts or assemblies. For Air Force medical facilities, field maintenance is limited to the services of precision measurement equipment laboratories (PMELs) and the Atlanta Army Depot.

Area maintenance. This is maintenance done by a medical equipment repair center (MERC) on a geographic basis. MERCs may be used to provide primary organizational or field maintenance support, or to augment existing organizational maintenance capabilities.

Exercises (458):

1. Match each statement in column A regarding the scope of responsibility with the type or kind of maintenance to which it most closely relates as listed in column B by inserting the appropriate letter in the blank provided.

Column A	*Column B*
______ (1) Performed by a using organization on its assigned equipment; consists of inspecting, servicing, lubricating, adjusting repairing, modifying, and replacing parts or assemblies and subassemblies. However, it requires the services of qualified maintenance personnel (performed by, or directly supervised by, qualified medical equipment repairers); it also requires use of tools and test equipment not available to the operator of the equipment.	a. Preventive maintenance.
______ (2) The care and servicing of equipment to retain it in a serviceable condition; is the joint responsibility of the medical equipment repairer and the operator or user of the equipment; includes routine maintenance items such as maintenance of oil levels, simple lubrication, and minor exterior repairs.	b. Organizational maintenance.
______ (3) Those major repairs, etc., performed only by PMELs and the Atlanta Army Depot designated to support using organizations (Air Force medical facilities).	c. Field maintenance.
______ (4) That maintenance performed by a medical equipment repair center functioning on a geographic basis.	d. Area maintenance.
______ (5) May be used to provide primary organizational or field maintenance support or to augment existing organizational maintenance capabilities.	

459. List common problems, sources of help, and procedures for user/maintenance of the dental operating unit.

Dental Operating Unit. As a dental assistant, you'll also have to care for dental operating units. You'll find that there are many types of these units and little standardization. They differ in design, shape, and manufacturer. Most of the units have water, air gas, and electrical systems. For practical reasons, the maintenance instructions we give here are necessarily general in nature. You'll find specific maintenance procedures in the equipment manufacturer's manuals. If these manuals aren't available in your clinic, ask your NCOIC to get the necessary copies.

Probably the best approach toward preventive maintenance of dental equipment is to begin each duty day by making a visual inspection, followed by an operational check. During the inspection, first look for obvious problem areas, such as frayed electrical wiring, missing screws, oil leaks, water leaks, and the like. Then make an operational check of each of the four systems mentioned in the above paragraph. For example, try working the water syringe and saliva ejector to check the water system. Try operating air-driven handpieces and air syringes to check the air system. Try lighting the gas burner to check the gas system. (NOTE: Be sure to turn the burner off after the check.) Start the engine to check out the electrical system.

Water system. A malfunctioning water system affects the operation of the water syringe, cuspidor, saliva ejector, cup filler, and handpiece water spray hookup. If any of the above items fail to work, first make sure that the necessary valves and switches are on. Then turn the main water valve off and check the associated filters and screens. If you can't solve the problem at this point, read the manufacturer's instructions before going on. Water leaks usually are the result of loose connections or defective washers and valves. When necessary, simply tighten the connection or have medical equipment repair personnel replace the defective part.

Air system. With the advent of air-driven handpieces, dental unit air systems have become more elaborate and complex. On some dental units, air is used to operate up to three air-driven handpieces, an air syringe, a spray syringe, and the handpiece lubricating system. This air needs to be as clean as possible to prevent contaminating dental patients and to protect expensive handpieces. The problem to watch for is—too much moisture in the air system. Moisture-laden air passing through precision-engineered handpieces tends to ruin them in rapid order. To end the moisture problem, drain the air tank and purge the air lines daily. Another problem that occurs in the air system is incorrect air pressure at critical points. Most air-driven handpieces operate on air pressure within the 20- to 60-psi range, with a specific pressure recommended for each handpiece. By following instructions furnished by the manufacturer, you can make fairly simple adjustments to meet the air pressure requirements. Either correct all air leaks or have them corrected as soon as possible.

Gas system. While the dental unit gas system is used less than the other systems, it presents the greatest harzard. You need to be on the alert at all times for gas leaks. If you smell escaping gas, take corrective action by locating the source and having it repaired immediately. If it's a defective gas valve, replace it. If the leak is in another area of the system, have the medical equipment repair section or the civil engineers (CE) repair it immediately.

Electrical system. Probably the most complex system on a dental operating unit is the electrical system. When there is a problem with this system, turn it over to a medical equipment repairer, unless you have had special training and have special electrical test equipment. Among the items affected by a dental unit electrical system are the dental engines, reservoir heaters (water and air), pulp testers, cautery devices, and solenoids (electrically operated switches).

Dental engine assembly. Every clinic has many types of dental units, and while their engine assemblies are similar, they aren't identical. Care for and do maintenance on these assemblies according to the manufacturer's instructions. When you have a major problem, call in a qualified medical maintenance repairer.

Syringes. Dental operating units usually have an air syringe and a water syringe; and many of the newer models have a combination syringe (air, water, and spray). If you have problems with the inner workings of any of these syringes, have a qualified medical equipment repairer repair or replace them. But if you can't find qualified help, do the maintenance yourself by following the manufacturer's step-by-step procedures. You'll find that problems with binding syringe hoses are usually easy to solve. First, remove the back unit panel. Then locate the offending hose. In most cases, all you'll need to do is realign the binding hose or lubricate the guide slides. Lubricate lightly with lightweight machine oil unless nylon or plastic surfaces are involved. If they are, use a silicone spray (dry) lubricant.

Saliva ejector. Neglected saliva ejectors can become a perpetual problem area. For this reason, daily preventive maintenance is very important. Daily maintenance consists of cleaning the screen and running a cup of water through the system. Do this at the end of the day and more often if necessary.

Cuspidor. A neglected cuspidor may also become a perpetual problem. It too requires daily maintenance. This maintenance consists of cleaning the entire bowl and the gold or amalgam trap. Failure to do so causes corrosion and may eventually clog the entire drainage system.

Exercises (459):

1. To what degree are dental operating units standardized?

2. What is the best source of specific maintenance procedures on dental operating units?

3. Summarize the preventive maintenance of dental operating units that is recommended at the beginning of each duty day.

4. What are two causes of water leaks that you or medical equipment repair personnel can correct?

5. Name two problems often encountered with the air system of the dental operating unit, and state how each may be corrected.

6. Because of the complexity of the electrical system and its interaction with other systems, what should an operator usually do about electrical system problems?

7. What lubricant is used for nylon or plastic surfaces of guide slides when there are problems with binding syringe hoses?

8. What is a likely result of not cleaning the entire bowl and the gold or amalgam trap of the dental operating units?

9. What preventive maintenance is made daily, or more often if necessary, that concerns the saliva ejector of dental operating units?

460. Specify operational characteristics of and maintenance procedures for dental operating chairs.

Dental Operating Chair. While there are many makes and models of operating chairs, all have certain things in common. For example, all can be raised or lowered, either manually or electrically. Also, on most the back, headrest, armrests, and footrest are adjustable. (See fig. 4-1.)

Before you do any maintenance on a dental chair, first do a simultaneous inspection and operational check. When inspecting the chair, make sure that the exterior surface is clean and well polished, and that there are no oil leaks. You also should look for broken or missing parts. The upholstery should be in good repair, with no tears or other damage. For the operational check, separate the chair into its two basic parts—the chair pump and the chair frame.

In the manually operated chair pump, the foot operating lever should move freely and smoothly and return to the UP position when released. The chair should remain at any desired height. Each stroke of the operating lever should cause the chair to rise. When the release lever is pushed, the chair should lower evenly and smoothly. If the chair has a speed control, it should vary the speed of descent. When the chair is raised to its maximum height, there should be no wobble or play.

All adjustments of the chair frame should be included in the operational check. The headrest, backrest, armrests, and footrest should move freely and smoothly and lock in any position. The chair tilt lever should allow the chair to be tilted and locked firmly in any position. The base of the chair is not normally moved for each patient. There are, however, chairs equipped with a track that allows forward and backward movement of the chair base.

Hydraulic system. The dental operating chair hydraulic system is activated by either an electric motor or a foot-operated lever. For the most part, this system is seldom a source of trouble. With proper care, the hydraulic system will function well for many years.

Of course, some hydraulic systems may turn out to be lemons. When this is the case, the associated problems may range from abnormal oil leaks to broken chairs. In such cases, you should call in the medical equipment repairer and perhaps a factory representative for needed assistance.

Some of the things that you may be directly concerned with are the reservoir fluid level, air or oil leaks, and the travel rate of hydraulically controlled chair parts. As a general rule, you should not attempt to repair or replace the

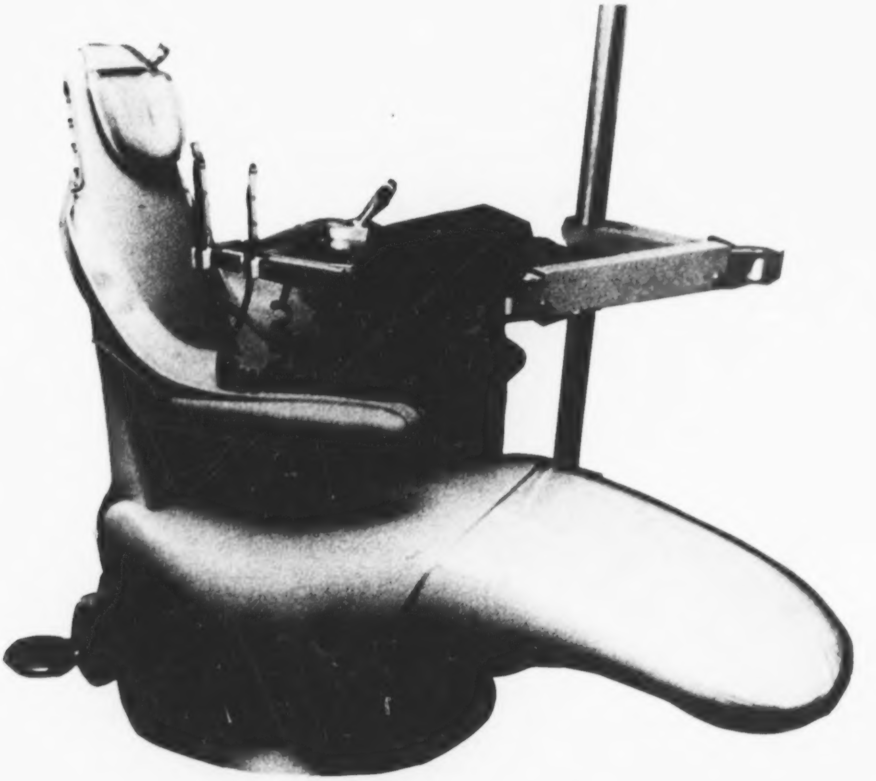


Figure 4-1. Dental operating chair.

inner workings of the hydraulic system—this is a job for a qualified medical equipment repairer.

The exact way to add oil to a dental chair hydraulic system varies with the different models and different manufacturers. Thus, you must consult the manufacturer's instructions for the correct fluid level and procedures for adding needed oil. Most dental chair hydraulic systems use S.A.E. 20-weight motor oil for the hydraulic fluid.

For a hydraulic system to work properly, the oil in the system must be free from air. Oil leaks eventually permit air to mix with the oil and cause sluggish operation. Extremely low levels of oil (also a broken chain) may prevent the system from working altogether.

To expel air from the system, you must first lower the chair to its lowest position. Then remove the seat cushion to gain access to the air vent screw. (See manufacturer's instructions.) Next, loosen the screw (turn counterclockwise) about one turn, and operate the foot lever or run the motor for a few seconds. While still working the foot lever or still running the motor, tighten the screw.

At times, the rate of travel for the hydraulically controlled parts of a chair may be too fast or too slow. On older chairs, only the up and down movements are hydraulically controlled. The rate of travel on these older chairs can be adjusted for slower and faster movements. On newer, electric-powered chairs not only is up and down movement hydraulically controlled, but also the forward and backward tilt of the backrest and entire seat. To find out how to get to these adjusting screws, read the manufacturer's instructions.

Other chair adjustment devices. Dental chair adjusting devices besides those already discussed are mostly the friction-control devices. Lubricate these devices with one drop of lightweight oil every 6 months. Some of the older headrest adjustment devices have an additional adjustment to control the degree of tightness when the lever is in the tightened position.

Exercises (460):

1. How can operating chairs, be raised or lowered?

2. List three things you should look for when inspecting a dental operating chair.

3. In the manually operated chair pump, the foot operating lever should move freely and smoothly and return to the ____________ position when it is released; each stroke of the operating lever should cause the chair to ____________; when the chair is raised to maximum height, there should be no ____________ or play.

4. How do you activate the dental operating chair's hydraulic system?

5. As a general rule, do not attempt to repair or replace the ____________ workings of the hydraulic system, since this is a job for a qualified ____________ ____________ ____________.

6. What type of oil do most dental chair hydraulic systems use?

7. To work properly, the oil in the dental chair hydraulic system must be free from ____________.

8. How do you lubricate friction-control-type devices used in adjusting dental chairs?

461. Specify the uses, speeds and maintenance procedures related to dental handpieces.

Handpieces. A dental handpiece is a precision-built mechanical device designed to rotate the burs, stones, wheels, and discs used in dental treatment. Handpieces are classified by their revolutions per minute (rpm), and come in three basic designs: straight, contra-angle and right-angle. As with most equipment, manufacturer modifications for marketing purposes are common.

Use and speed of handpieces. *Low speed,* 6,000 to 10,000 rpm, are used for buffing and refining of a cavity preparation. They are used with the abrasive stones, discs, etc. They also are used in performing prophylaxis. *Ultra speed,* 100,000 to 800,000 rpm, are used in cavity preparations, the preparation of retention grooves and bevels within a cavity preparation, the bulk removal of enamel and dentin, the development of the cavity outline and the removal of old metal restorations, such as amalgams, inlays, and onlays. Constant preventive attention is essential in caring for handpieces. If they are not properly cleaned and lubricated, abrasives, such as finely ground tooth, metal, and other particles, will cause excessive wear. This wear causes undue vibration.

Slow-speed, air-driven handpieces. Some dental units now have a slow-speed handpiece powered by the air system. These handpieces can also be started by working the foot controller (rheostat). Most of these handpieces are lubricated by the air forced system. The biggest difference between the slow-speed, air-driven handpieces manufactured by various companies is in the amount of oil required for each type of handpiece. Some of these slow-speed, air-powered handpieces also may require additional lubrication in certain areas. Always check with the manufacturer's instructions before doing any maintenance.

Ultra-speed handpieces. Ultra-speed handpieces are also operated by air pressure. Before you use one, consult the appropriate manufacturer's instructions. All models of the ultra-speed handpieces work on the same basic principle: The bur is held in the handpiece by either a friction grip chuck or by a chuck that requires manual tightening. These chucks are a part of the bur tube and should be changed by the manufacturer's instructions. The bur is rotated when air is forced through the airports into the head of the handpiece and to the air turbine.

Ultra-speed handpieces are operated in part by the air system, in part by the water system, and in part by the electrical system of a dental operating unit. The controls for operating a handpiece will either be in the dental operating unit's or control cabinet the unit itself.

The *air system* helps to operate several parts of the ultra-speed handpiece. Its main function is to rotate the air turbine, which means it's the main power source for ultra-speed handpieces. On some handpieces, the air system also keeps the handpiece cool. Another function is to move lubricant from the lubricant reservoir to the handpiece. All ultra-speed handpieces are not so equipped. You'll have to lubricate these yourself. Be sure that you read the manufacturer's instructions for the lubrication requirements for each handpiece. The air system also may supply air to the handpiece for blowing chips of tooth structures from cavity preparations. For each of these air system functions, there is a separate air line. Normally, these lines merge at some point on the unit and are connected by a multiple-line, flexible hose. As a precautionary measure, the main air line has a filter that prevents moisture in the air system from reaching the handpiece bearings. Some units also have a purging valve to keep down excess moisture. Change these filters as the manufacturer directs.

The *water system* plays a smaller role than the air system. Its main function is to keep the handpiece cool. As mentioned earlier, this cooling requirement also may be performed by the air system. The water system also emits a fine spray mist, which aids in rinsing debris from the operating site.

The *electrical system* function in operating the ultra-speed handpiece is to activate solenoids, which control the other systems. To start the action, the operator flips a foot switch. The switch may be a separate mechanism or it may be built into the dental operating unit. The built-in type also may be used to operate a separate dental engine. There is usually a switch on the foot controller so that the operator can change from the dental engine to the air-driven system and back with ease.

The proper lubrication of ultra-speed handpieces is of such importance that it cannot be overstressed. Most ultra-speed handpieces are lubricated by the air-forced system, and require frequently checking to see whether the correct amount is reaching the handpiece and whether the reservoir level is adequate. To be safe, read and reread the manufacturer's instructions to make sure that you understand the lubricating requirements. Then take the necessary measures immediately. It takes only a few seconds to ruin an ultra-speed handpiece that has improper or insufficient lubrication.

Exercises (461):

1. Match each statement in column A with the most applicable system or component in column B by inserting a letter in the appropriate blank.

Column A

_____ (1) Each separate air system has one, all of which normally merge at a point on the unit (and are connected to the handpiece by a multiple-line, flexible hose).
_____ (2) Operated in part by the air system, in part by the water system, and in part by the electrical system of a dental operating unit.
_____ (3) Held in the handpiece either by a friction grip chuck or a chuck that requires manual tightening; is rotated when air is forced through the airports into the handpiece's head and onto the air turbine.
_____ (4) Main power source for ultra-speed handpieces; sometimes another function is to move the handpiece lubricant from the lubricant reservoir to the handpiece; also may clear cavity of chips.
_____ (5) Some units have this component as a means of eliminating excess moisture.
_____ (6) Its prime function is to keep the handpiece cool; also aids in rinsing debris.
_____ (7) It takes only a few seconds to ruin this type of handpiece if there is improper or insufficent lubrication.

Column B

a. Ultra-speed handpieces.
b. Bur of ultra-speed handpieces.
c. Air system of ultra-speed handpieces.
d. Separate air line.
e. Purging valve.
f. Water system of ultra-speed handpieces.
g. Electrical system of ultra-speed handpieces.

462. Identify the maintenance procedures for conventional-speed, contra-angle and right-angle prophylaxis handpiece attachments.

Angle Handpieces. The next handpiece we cover is the conventional-speed, contra-angle attachment. This handpiece should be lubricated after each 5 hours of use. There are two lubrication points on this attachment. (See fig. 4-2 for the location of these holes.) Using handpiece grease recommended by manufacturer, insert the tip of the grease tube into the hole in the elbow until it begins to escape at the junction of the tube tip and hole. The other lubrication point is under the bur lock latch. Open this latch and repeat the procedure.

The angle handpiece should be thoroughly cleaned and lubricated after each 10 hours of operation. The handpiece must be disassembled for this kind of cleaning. Refer to figure 4-2 during this discussion of the disassembly of the handpiece. Using two pairs of pliers with friction tape-covered jaws, disassemble in the following order:

- Remove the cap from the bur tube.
- Remove the head assembly for the adjoining bearing assembly.
- Remove the bearing assembly from the knee housing.
- Remove the knee housing from the drive shaft housing.

Place these parts in handpiece cleaner and flush thoroughly until they are clean, then dry them with paper towels. The handpiece is now ready to be lubricated. Carefully pack grease into the elbow and the head assembly as you reassemble the component sections. Reassemble by reversing the disassembly procedure. Use tools carefully to prevent marring the plated finish. It is important that the knurled end of the bearing section and the head be properly aligned to the elbow. Aligning the lubrication holes in the elbow and head will assure proper relationship.

The right-angle prophylaxis handpiece should be cleaned after each use. Refer to figure 4-3 as we cover the procedures for cleaning the handpiece. Use the wrench provided by the manufacturer to remove the bottom nut (which on some models has left-hand threads), being careful not to scratch the chrome finish. Remove the inner gear, which will drop out with a light tap. Place the nut and gear in a handpiece cleaner. Run the handpiece in the cleaner for 1 minute forward and 1 minute in reverse; then wipe it clean with a paper towel. Pack the head with an approved lubricant, and lubricate the nut and gear with oil. Carefully reassemble the handpiece and test run it. If it overheats, disassemble and reclean it. When the test run is satisfactory, wipe the exterior with a gauze moistened with 70 percent isoprophyl alcohol.

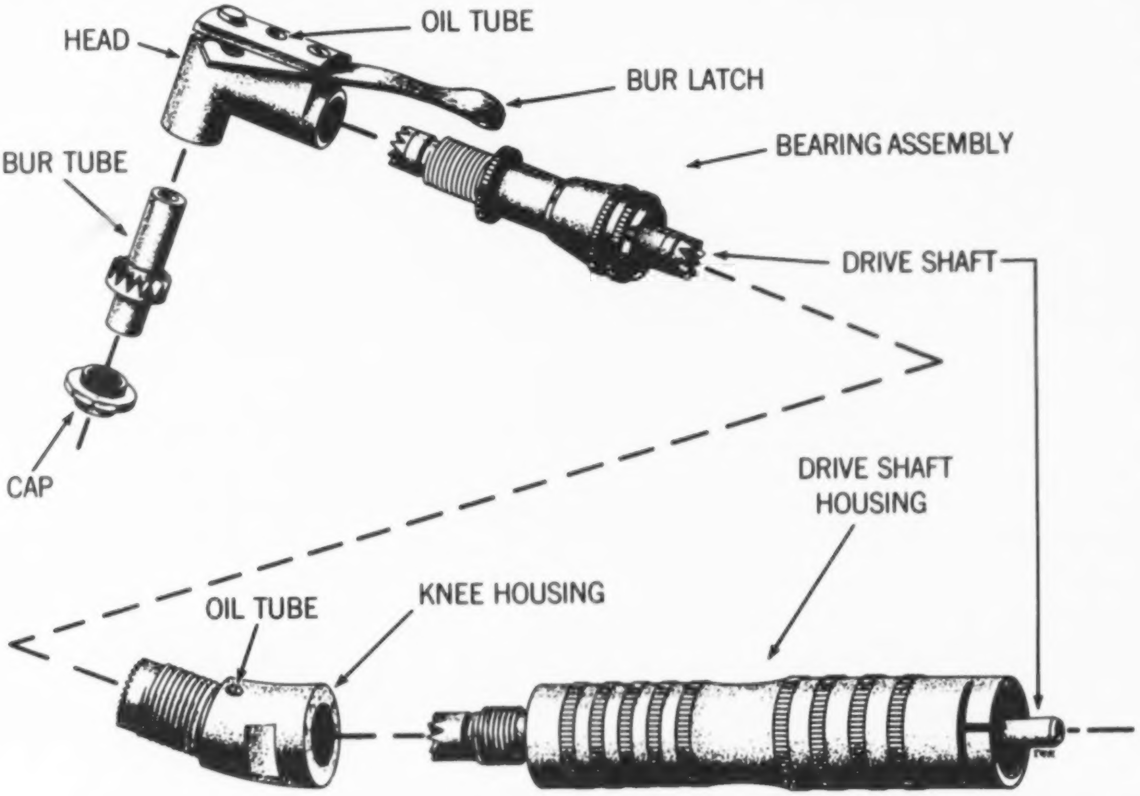


Figure 4-2. Conventional-speed, contra-angle attachment.

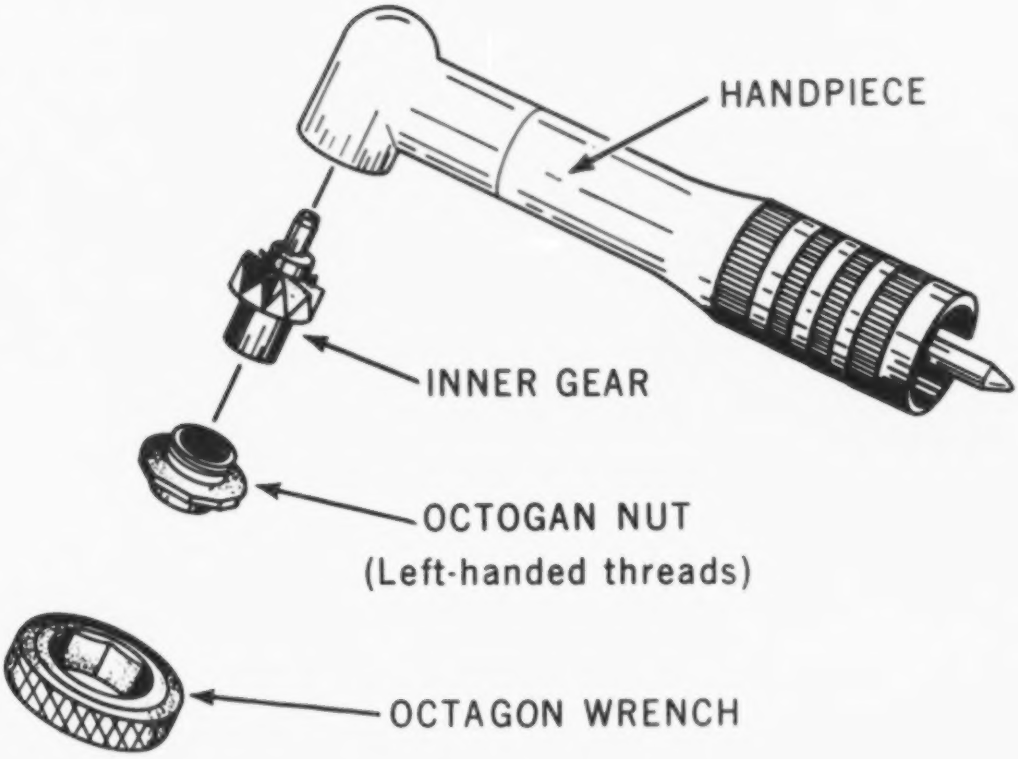


Figure 4-3. Prophylaxis handpiece.

Exercises (462):

Mark each exercise that follows T (true) or F (false). Explain any false answers.

_____ 1. Lubricate this handpiece after each 5 hours of use.

_____ 2. Insert the tip of a tube of handpiece grease into each of the two lubrication points and squeeze until the grease begins to escape.

_____ 3. Thoroughly clean and lubricate the angle handpiece after each 10 hours of operation, but do not disassemble it.

_____ 4. As a part of proper maintenance, and after the disassembled parts have been cleaned and dried, they are then lubricated and reassembled in the following order: (1) knee housing to drive shaft housing; (2) bearing assembly to knee housing; (3) head assembly to bearing assembly; (4) cap to bur tube.

_____ 5. The tools used in disassembly and reassembly are so constructed that you cannot mar the plated finish.

_____ 6. Maintenance of the above handpiece and the right-angle prophylaxis handpiece are identical in every respect.

_____ 7. You should run the right-angle prophylaxis handpiece in the cleaner 2 minutes forward and 1 minute in reverse.

463. Identify maintenance procedures for rotary instruments.

Rotary Instruments. There are two types of burs: those used with the straight handpieces and those used with the contra-angle handpieces. These burs are made of tungsten carbide and carbon steel. We also use diamond-coated rotary instruments.

Carbon steel burs. Care for these burs is simple. If the bur is serviceable after use, clean it, disinfect it, and replace in its holder. Use a stiff wire brush to do the cleaning. If the bur is not serviceable, throw it away and replace it with a new one. All types and sizes of burs are always available.

Tungsten carbide burs. These burs require little maintenance, because the coolants used with them prevent debris from clogging their grooves. Should they become clogged, clean them with a stiff wire brush. Although tungsten carbide burs last well, they do wear out. If you find any worn burs, discard them. Disinfect tungsten carbide burs in 70 percent solution of isopropyl alcohol. Do not place them in benzalkonium chloride. This will cause them to corrode and will shorten their usefulness.

Diamond-coated instruments. These instruments do not become as clogged at higher speeds as they do at lower speeds, because of the light pressure used in cutting at high speeds. If debris does collect in the diamond grit, soak the instrument in soapy water for about 5 minutes and then scrub it with a bristle brush. You also may use a rubber-impregnated disc or ink eraser. You may clean it with a rubber eraser by applying it against the instrument while it is slowly turned in the handpiece. Old amalgam may be removed by soaking the diamond instrument in pure mercury and then using a brush or an eraser to remove the partly loosened amalgam. Avoid boiling and autoclaving diamond instruments. Doing so causes the bonding material to deteriorate.

Exercises (463):

1. Match each of the maintenance procedures listed in column A with the applicable items listed in column B by inserting a letter in the appropriate blank.

Column A	*Column B*
_____ (1) Require little maintenance, because coolants prevent debris from clogging their grooves.	a. Carbon steel burs.
_____ (2) Clean with stiff wire brush.	b. Tungsten carbide burs.
_____ (3) Normally clean by scrubbing with a bristle brush after soaking it in soapy water for 5 minutes.	c. Diamond-coated instruments.
_____ (4) When necessary, soak this rotary-cutting instrument in pure mercury to partly loosen old amalgam, then remove the loosened amalgam with a brush or an eraser.	

464. State procedures for using and maintaining dental lights.

Dental Operating Lights. Most of the maintenance required for dental lights consists of changing burned-out bulbs. Of the two types of lights, the most common one mounts onto the dental operating unit; the other one mounts on the ceiling. Some of the newer types have bulbs which require special handling. Read the required literature before you attempt to change the bulb. When changing a light bulb, use a dry towel to protect your hands in case the bulb shatters. Dental operating lights require lubrication for the joints of their movable parts about every 6 months. Use a small amount of lightweight machine oil.

Exercises (464):

1. What is the most frequent thing you'll have to do to maintain dental lights?

2. Where does the most common type of dental light mount?

3. What should you use when changing a light bulb?

4. Give a general rule for lubricating the joints of movable parts of dental operating lights.

465. Specify maintenance procedures for the aspirator and the oral-suction apparatus.

Aspirators. Aspirators are vacuum devices used to keep the operating field clear. It has an electric motor (see fig. 4-4) that operates a vacuum pump. A bottle connected to the vacuum pump holds aspirated material. A rubber tube runs from the bottle to a handle with tips of various sizes. A

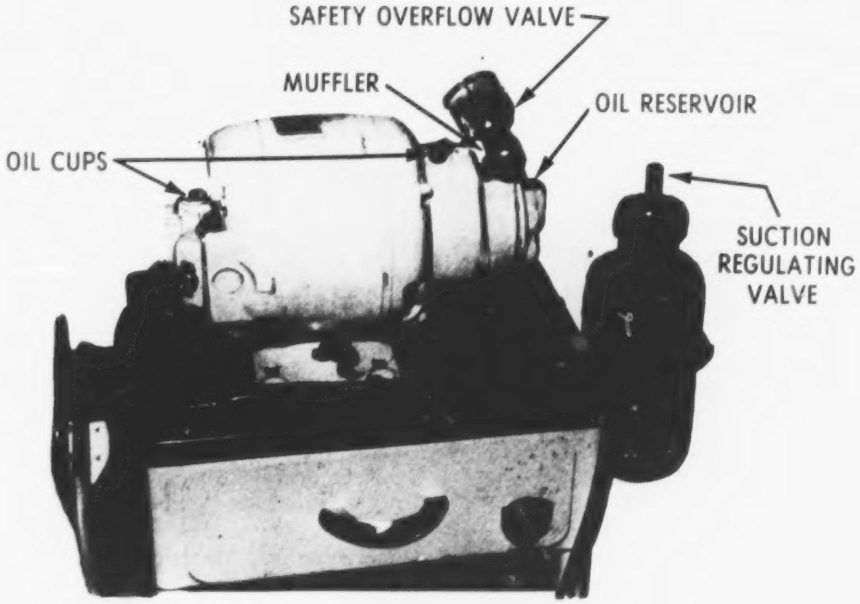


Figure 4–4. Aspirator.

valve located on top of the vacuum bottle adjusts the suction of each tip. There is a safety overflow valve with a chamois disc between the bottle and the vacuum pump. Its purpose is to protect the pump from fluids that may overflow from the bottle. When the chamois disc becomes wet, it stops the flow of air and cuts off the suction.

Check the aspirator each morning before starting the day's work. Make sure that the electric cord is long enough and that it doesn't needs repair. The cord must have a grounded plug. The motor and pump mounts must be secure. You must be able to vary the pressure from 0 to 20 pounds. The motor and pump must start as soon as you turn them on. They must run with no excessive vibration. You'll need to check certain items, including the cotton muffler and the oil reservoir, weekly. Lubricate the electric motor monthly.

Make sure you have the right amount of oil in the reservoir. Change the cotton in the muffler when it becomes moistened with oil. There are two oil cups, one on each end of the motor. Place two drops of oil in each of these. After each use, flush a generous amount of water through the suction system to prevent clogging. If the bottle overflows, replace the chamois disc with a dry one. After each operation, empty the bottle and put an inch of water in it, and remove and autocalve the handles and tips. Clean the rest of the unit with a 70-percent solution of isopropyl alcohol.

Oral Evacuators. Ultra-speed handpieces with water as the coolant have come into general use. This water must be removed from the patient's mouth. The most efficient way to do this is with a high-speed turbine oral evacuator. The principle of this evacuator is low pressure and high volume. Larger tips that will not harm oral tissues may be attached to these units to allow for faster removal of fluids and debris. These units come as table models, portable units, or units which may be attached to the light arm or the wall. The units attached to the light arm usually have an automatic drain into the cuspidor. The other units have a self-contained canister which you must empty periodically. All units have a filter, which may be either a bag or a wire screen. Clean or change the filter at the end of each day. Clean and polish the oral evacuator weekly.

Exercises (465):

1. Inspect the aspirator each ____________. Its electric cord must be sufficiently long, in good repair, and equipped with ____________ plugs. The motor and pump must vary the pressure from 0 to ____________ pounds and operate with no excessive ____________. The cotton muffler and oil reservoir require a ____________ check, but the electric motor requires ____________ lubrication.

2. Aspirator maintenance includes: (1) Maintaining the ____________ level in the reservoir. (2) Changing the cotton in the ____________ when it becomes moistened with ____________. (3) Placing ____________ drops of oil in each oil cup at each end of the motor. (4) After each use (to prevent ____________) flushing a generous amount of ____________ through the suction.

3. What do you do with the chamois disc when the aspirator bottle overflows?

4. After each operation, what should you do to the aspirator bottle?

5. What must you do periodically with the self-contained canisters of some oral evacuator units?

6. How often is the filter (bag or wire screen) of an oral evacuator cleaned or changed?

7. How often is the oral evacuator cleaned and polished?

466. State maintenance procedures for dental operating stools.

Operating Stools. More and more, dental operating stools are playing an important role in the practice of dentistry. This is due largely to new techniques that require the dentist and his or her assistant to work from seated positions. There are several types of stools. The type most often used in sit down dentistry is the mobile type. Another type often used is the single-shaft, solid-base type.

Maintenance on the mobile stools consists of making adjustments and lubricating the caster bearings. These adjustments involve the seat height and the backrest position. Lubricate the caster bearings with lightweight machine oil monthly. Maintenance on the single-shaft stool involves making seat-height adjustments and keeping the stool clean. Never lubricate the shaft on these stools, because doing so would keep the locking mechanism from holding in its adjusted position.

Exercises (466):

1. Maintenance on mobile stools consists of adjusting the ____________ height and the backrest ____________ and of lubricating the ____________ bearings with lightweight machine oil ____________.

2. Maintenance on single-shaft stools includes making seat-height adjustments and keeping the stool ____________. Never lubricate the ____________, because doing so would keep the ____________ mechanism from holding.

467. Identify maintenance procedures for various types of sterilizers.

Sterilizers. In Volume 2, you studied the use of sterilizers. In this section, we will cover their maintenance. Although the Air Force has many types of sterilizers, such as those using gas, chemicals, and heat, dental clinics use only those that use heat. The most popular ones include the autoclave, dry-heat sterilizer, and the heat-transfer sterilizer, which is often referred to as the bead or flash sterilizer.

The autoclave uses heat to convert water into steam under pressure. Distilled water should be used to keep mineral deposits from accumulating. Each autoclave has a mark to indicate the correct water level. Make sure that water is at this level before each use. Completely clean the interior weekly. You can clean the light scale that may form with soap, water, and a stiff brush. If you fail to use distilled water, a heavier scale may form. To remove this scale, add one-half cup of vinegar to the required amount of water, and operate the autoclave through a regular sterilizing cycle. Remove the vinegar water and rinse the inside thoroughly. Refill the unit to the correct level with distilled water. The autoclave must be on a solid surface, with the electric cord out of the traffic area. The cord must be in good repair with a grounded plug.

Another method of sterilization uses the dry-heat oven. This is a small electric oven. There is little maintenance that you can perform on these ovens, except to keep up their appearance by frequent dusting. If a unit fails to run, call in medical maintenance personnel.

Heat-transfer sterilization uses intense heat applied for a short time. The sterilizer using the "flash" principle is a small unit used to sterilize small instruments, such as root canal files (used to smooth root canals in endodontics). This electrically heated sterilizer uses glass beads, salt, or molten metal as a heat-transfer medium. The transfer medium is heated to intense heat (424° F. to 532° F.), and the instrument is inserted into the medium for 3 to 10 seconds. Little maintenance is required for flash sterilizers. The electric cord and plug must be grounded and in good condition. Because of the intense heat, be extremely careful when moving these sterilizers. The heat-transfer media may spill on you, causing a severe burn.

Exercises (467):

1. Match each statement in column A with the applicable sterilizer in column B by placing the appropriate letter in the blank provided.

Column A

_____ (1) This sterilizer is a small electric oven, upon which you perform little maintenance except frequent dusting.

_____ (2) This sterilizer uses heat to convert distilled water into steam under pressure. It has a mark to indicate the correct water level.

_____ (3) On this sterilizer, you remove heavy scale by adding one-half cup of vinegar to water and operating the sterilizer through a regular cycle; remove the water, rinse the unit, and refill with distilled water.

_____ (4) This "flash" sterilizer applies intense heat for short durations, but little maintenance is necessary.

_____ (5) Remove light scale from this sterilizer with soap, water, and a stiff brush.

_____ (6) This "flash" sterilizier's electric cord and plug must be grounded and kept in good condition. Be careful when you move the sterilizer as you might receive a severe burn if you spill its heat-transfer medium (glass beads, salt, or molten metal).

Column B

a. Autoclave.
b. Dry-heat sterilizer.
c. Heat-transfer sterilizer.

468. Identify true statements about dental amalgamators.

Amalgamators. An amalgamator is a device used to prepare a mix of dental amalgam. It has a small electric motor which rotates an eccentric cam. A forked prong is attached to this cam. The capsule with alloy and mercury is placed in the forked prong. The cam rotates, causing the prong to move in a figure "8." The amalgamator has a timer that controls the mixing time (see fig. 4-5.).

In caring for this equipment, you need to keep it clean and polished. Remove any objects that fall into the case through the prong opening by unpluging the amalgamator and turning it upside down. Gently rotate it back and forth until the object falls out. Don't attempt to remove the case from this equipment. If you replace it incorrectly, you can damage the wiring or bearings.

Exercises (468):

Identify each of the following statements as either true (T) or false (F). Explain any false answers.

_____ 1. When the small electric motor of an amalgamator operates, a rotating cam causes the prong to move in a figure "8" pattern.

_____ 2. Remove objects which fall through the case at the opening for the prong by reversing the motor.

_____ 3. The case for the amalgamator can be removed at any time.

_____ 4. The amalgamator timer can be adjusted to vary the number of seconds of mixing before cutoff.

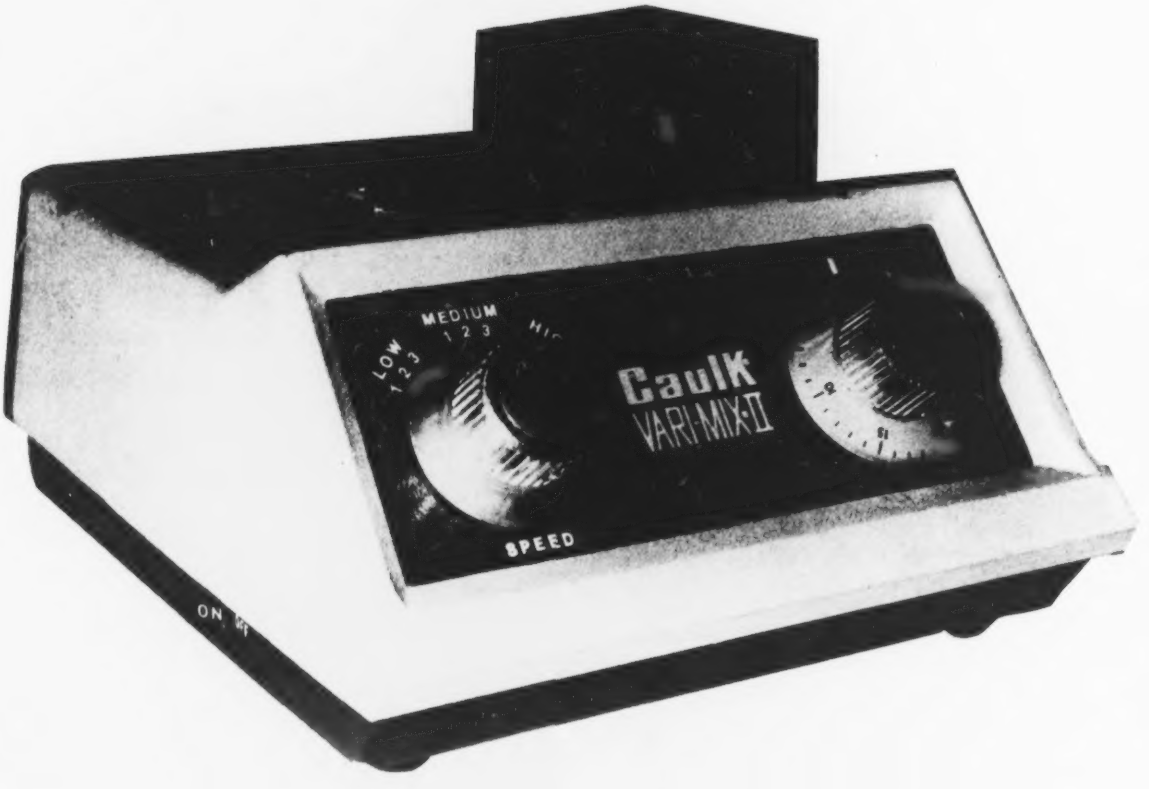

LOW
1 2 3
MEDIUM
1 2 3
HI
Caulk
VARI-MIX-II
SPEED
ON

Figure 4–5. Amalgamators.

Professional Standards and General Assisting Procedures

AS A MEMBER of the dental career field, one of your prime duty is to assist the dental officer. To do a good job, you need know the professional standards for our field and the fundamental assisting procedures.

5-1. Professional Standards

Most people think well of the people in the health care field. They admire and respect us. This feeling of good faith didn't happen by accident—it was earned through our observance of the standards set by our profession. These standards include our professional relations, behavior, and ethics. This section covers these standards and the legal implications of the dental health team.

469. State the purpose for professional standards in the Dental Services and given a list of actions, identify those that could result in legal implications.

Professional Relationships. Good relations with your coworkers and patients promotes harmony, which makes your job more enjoyable and contributes to a smoother running, more reputable dental service. To have good relations, you need to meet the basic psychological needs of the people you work and deal with. As you recall, these needs are security, recognition, affection, and achievement.

Behavior. As a member of the dental profession, your behavior is very important. Since you work in a professional atmosphere, anything you do to distract from the atmosphere degrades your profession. Patients come to the dental clinic for treatment by professionals—don't let them think you are anything less. Even harmless "horseplay" can have a negative effect on a patient who is in pain or who is apprehensive. Abusive or offensive language has the same effect. Always refrain from any unprofessional actions in patient areas. This includes the reception area and waiting room, since this is where the patients form their first impression. Also, remember the white uniform you wear is a symbol. It identifies you with the medical services. Always behave while in whites in such a way to bring honor on your profession.

Professional Ethics. Just as physicians and dentists have a code of ethics, so do dental assistants. The following code of ethics was formulated by the American Dental Assistants Association (ADAA). It applies to both military and civilian dental assistants. Study it carefully.

"The spirit of the Golden Rule (which is to do unto others as you would have them do unto you) should be the guiding principle of conduct for the dental assistant. In all your contacts with the dental profession and society you—should maintain honesty, loyalty, and desire to serve to the best of your ability, your dentist, your organization, and above all our patients."

You should give to your dentist and your organization the cooperation they need to serve our patients capably and efficiently. You will hold in confidence the details of professional service rendered by your dentists. You should refrain from performing any service for patients which requires the professional competence of the dentists, or which may be prohibited by applicable dental practice acts of the state in which employed.

You should avoid making any disparaging remarks about the conduct of the profession you serve or your dentist's treatment of his or her patients.

You have the obligation of increasing your skill and efficiency by availing yourself of the educational opportunities provided by the American Dental Assistants Association and its component societies. You should take part in the efforts of these groups to improve the educational status of the dental assistant and should support this Code of Ethics.

Legal Implications. Laws established by the American Dental Association and the State Dental Practice Acts provide for the legal practice of dentistry. Since the dentist is licensed and you are not, he or she is legally responsible for patient treatment. This, however, does not relieve you of your responsibility. You must be aware of these legalities to prevent compromise of the existing laws. Let's look at some legal complications in which you could be involved.

Performing unauthorized services. Each state has a Dental Practice Act, which authorizes the allowable duties of civilian dental auxiliaries. These duties vary from state to state. For instance, some states let auxiliaries expose radiographs; others don't. As a military dental assistants, you are not limited by the Dental Practice Act. Your duties are summarized in AFR 39–1, *Airman Classification Regulation*. These duties as they appear in AFR 39–1 can be found in Volume 1, Chapter 2, of this CDC. You must know your legal restrictions and not surpass them, regardless of how qualified you feel.

Leaving patients unattended. You have probably seen patients experience syncope or drug reactions and fully realize why patients shouldn't be left unattended. Nevertheless, this cannot be overemphasized. If the dentist leaves the treatment room, be sure you stay with the patient. Patients who are injured by falls or medication reactions while unattended could file and probably win a lawsuit.

Privileged communications. In your work you are exposed to much information that is considered privileged communication. The best way to avoid violating privileged communication is to simply refrain from talking about your patients. Health histories may reveal that Mrs. X has had a breast removed or Sergeant Y has had a venereal disease. This is nobody's business but yours, the dentist's, and the patient's. Don't spread it around. Don't even discuss a patient's routine treatment with someone who doesn't have a need to know. Keep the business of the treatment room in the treatment room.

Prescribing treatment. Many times patients will ask you what treatment the dentist is going to perform. Although it seems harmless enough to tell them, it can cause problems. For instance, you tell a patient that the dentist is going to restore a tooth; then the dentist examines the radiograph and decides to pull the tooth. Now the patient has two conflicting treatment plans. Which one is right? The patient could feel the dentist is pulling a tooth that could be saved and bring legal action against him or her. For this reason, always let the dentist explain the exact treatment plan.

Equipment maintenance. If a patient is injured because of faulty equipment, the dentist may be charged with negligence. Since the maintenance of equipment is your responsibility, you must be sure everything is working properly. Pay particular attention to X-ray units and operating lights that could fall and injure the patient.

Sterilization. The use of unsterile technique can result in liability. The dentist relies on you to properly sterilize the instruments and to help him or her avoid patient contamination. There is no excuse for shortcutting sterile techniques. You must observe the proper sterilization procedures and frequently check your sterilizers to make sure they are operating properly.

Drug administration. You need to be very careful when administering drugs. Giving the wrong drug is negligence. To avoid this, make sure that all drugs are properly labelled and that you always tell the dentist what drug you're handing him or her.

Exercises (469):

1. What is the result of having good professional relations with patients and coworkers?

2. How can you have good professional relationships?

3. Why should you refrain from horseplay in the patient areas of the dental clinic?

4. What should be used as the guiding principle of conduct for the dental assistant?

5. Identify each action that could result in legal implications by placing a checkmark next to the action.

____a. Seating the patient in an uncomfortable position.
____b. Leaving a medicated patient unattended.
____c. Telling the patient what treatment the dental officer is going to perform.
____d. Mixing materials according to manufacturer's instructions.
____e. Shortcutting sterile techniques.
____f. Discussing the patient's health history with the dentist.
____g. Underexposing a radiograph.
____h. Administering the wrong drug.

5-2. Fundamental Assisting Procedures

During your career, you may assist several dental officers. You may further assist in several or all of the dental specialities. In doing so, you will find dental officers do not always carry out procedures in the same way. Dental officers generally follow a similar pattern, but because of individual preferences and variations in professional training, each works somewhat differently. So, you must learn the favorite instruments, medications, and procedural routines of each dental officer. Even though there are variations in treatment routines, there are fundamental assisting procedures and knowledges you need to be an effective dental assistant. This section covers these procedures and knowledges.

470. State procedures for receiving patients.

Receiving Patients. How you receive dental patients is critical. Your actions and reactions give patients a certain impression. A good impression aids in patient treatment; a bad impression hinders dental treatment. In all you do, try to exert influence that aids each patient's treatment. There are three functions in receiving patients: you prepare for the patient; you greet him or her; and you seat the patient in the dental chair.

Preparation. Some patients are apprehenisve when they come for their appointment. The way you prepare the treatment room can do much to ease their fears. Make sure that the dental unit and other dental cabinets, work surfaces, arms of chairs, and lamps are clean and disinfected. Use an alcohol sponge or an approved disinfectant. Clean the cuspidor of debris and blood, since this is the area a patient observes when he or she expectorates. Store all paperwork in cabinets or desks. Also, neatly arrange all medicaments and instruments, displaying as few as possible for the patient to see. Apprehensive patients don't like to see instruments and medications. Make sure that hand towels are clean and neatly arranged. Place the standard diagnostic instruments (mouth mirror, explorer, and cotton pliers) on the bracket table along with a clean saliva ejector. Place a cover or liner on the bracket table.

When the treatment room is ready, review the patient's dental health folder to see:

- If the record is complete.
- If information is current.
- If you have the correct record for the patient being treated.
- If positive responses on the dental patient history forms are indicated on the outside of the folder.

If you find that the folder contents are incomplete, not current, or incorrect, do what you can to correct the problem. Make sure you let the dentist know of any positive responses to any questions on the patient's medical history form (AF Form 696). Do this before the patient is seated.

Greeting. Now that you have made the necessary preparations, you are ready to receive the patient. Whenever possible, walk to the waiting room and greet the patient pleasantly by his or her name and rank. Do your best to call out the correct rank and to say the patient's name correctly. Failure in either instance can irritate the patient and embarrass you.

In some dental clinics, a clinical intercommunication sound system is used to direct patients to the treatment rooms. If this system is used in your clinic, be sure to greet the patient at the door of the treatment room. Regardless of the system used, be sure to greet each patient pleasantly by name and rank. Also, be sure to let the patient know if there is a chance he or she will not be treated at the scheduled time. Failure to do so angers the best of patients.

Should you walk to the waiting room to call the patient, or should your dental officer refer a patient to another section, it is good practice for you to escort the patient. In doing so, you can use light conversation to relieve the patient of any apprehension. The weather or the patient's hobbies are good subjects. Avoid subjects which could cause a controversy between yourself and the patient. For example, a controversial subject might be the patients dental treatment or needs.

Seating. Just before you seat the patient, relieve him or her of anything that might interfere with the treatment. An example is the patient's spectacles or coat. Some dental officers prefer to seat the patient and adjust the chair. But most expect you to seat the patient.

In seating the patient, you want him or her as comfortable as possible. A comfortable individual makes a better patient. Before seating the patient, lower the chair to its lowest position and swing the bracket table out of the way. If the chair has an adjustable backrest and headrest, set it before hand for an average patient. If you do this, you can make further adjustments more easily and accurately. Stand behind the chair as the patient is seated and then make the necessary adjustments.

There is no one seated position suitable for all dental operations. The correct patient position varies because of the arch (maxillary or mandibular) being treated, because of the training of the dental officer you assist, and because of the nature of the treatment. A good rule to follow is to have the occlusal plane of the patient's mandibular teeth parallel with the floor when his or her mouth is open. If you are in doubt about the correct patient position, ask your dental officer. Figure 5-1 shows the correct and incorrect positions of a patient in a dental chair.

You'll be able to finish most of the patient seating procedures before the dental officer enters the treatment room, and when you do, keep up a light conversation with the patient. If the patient asks questions about his or her treatment, you may answer if it is within your responsibility. But in doing so, be careful you don't commit the dental officer to a treatment plan he or she cannot fulfill. Do not attempt to impress patients with your knowledge about dental professional matters. Refer any questions about the professional aspects of patient treatment to the dental officer. A final important point: Don't leave the patient unattended at any time during the course of treatment. Instead, keep a close watch on the patient and let the dental officer know of any abnormal responses (pale, flushed, or clammy skin, etc.).

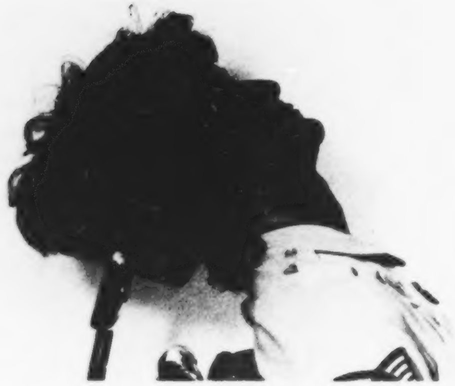
Exercises (470):

1. What are the three functions involved with receiving patients?

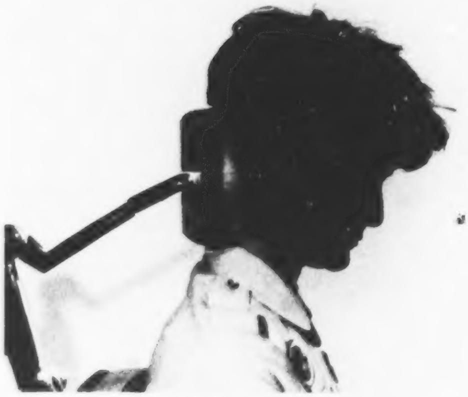
2. What should you use to clean and disinfect the dental unit, cabinet, chair arms, and the dental lamp?

3. What instruments should you place on the bracket table during the preparation phase? What should you do with the other instruments?

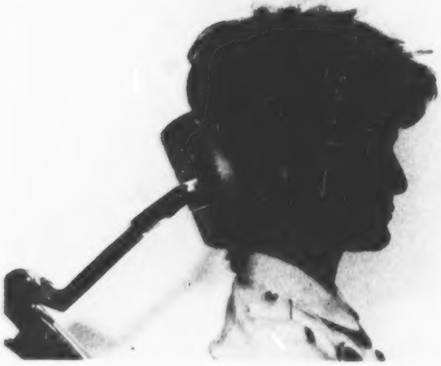
4. What should you determine by your review of the patient's dental health folder?



HEAD TOO FAR BACK
A



HEAD TOO FAR FORWARD
B



CORRECT POSITION
C

Figure 5–1. Correct and incorrect patient position in a dental chair.

5. When should you bring discrepancies you find in a patient's health record to the attention of the dental officer?

6. Whenever possible, how should you greet the patient?

7. Where should you greet the patient if you use the clinic's intercommunication system to direct the patient to your treatment room?

8. What topics are acceptable for conversation when escorting a patient?

9. How should you position the dental chair before seating each patient?

10. What tooth plane should be parallel to the floor when you have the patient seated?

11. What should you do after you have seated the patient and are waiting for the dental officer to enter the treatment room?

471. State procedures for draping dental patients.

Draping the Patient. Once the patient is in a comfortable position, he or she is ready for draping. Normally, there are two types of patient drapings: the routine drape and the surgical drape. The type of drape you select depends on the procedure and the dentist's preference.

Routine drape. The primary purpose of the routine drape is to protect the patient's clothing. Use it when there is little chance of contamination. The most common patient drapes are linen, paper, and plastic-backed paper towels. They are held in position by a towel chain, which is put around the back of the patient's neck. When using the plastic-backed paper napkin, be sure the paper side faces outward. This way the towel will absorb any spilled liquids and the patient won't have to worry about his or her clothing. Some clinics use a plastic apron that covers the anterior surfaces of the patient's torso to the knees. This apron is particularly useful for protecting the patient's clothing when the cavitron is being used.

Surgical drape. You'll use this drape when there is a good change of contamination. Its use serves three functions: (1) It prevents an apprehensive patient from seeing instruments that might further aggravate his or her tensions.

(2) It keeps the bright operating light from shining into the patient's eyes.

(3) Since the Mayo or instrument stand is customarily placed behind the patient, the surgical drape prevents the patient's hair from contaminating the instruments. Using sterile towels, apply the surgical drape in the following manner:

- Have the patient lift his or her head from the headrest.
- Lay two hand towels across the headrest, taking care not to contaminate your gloves.
- Have the patient lay his or her head back on the towels.
- Crisscross the top towel across the eyes and head and secure it in place with a towel clamp.

Allow the bottom towel to drape naturally around the neck and shoulders of the patient. Finally, cover the patient's chest with a drape and secure it at the back of the neck to the bottom head drape towel with a pair of towel clamp forceps. When you have properly draped a patient, everything in the operative field will be covered except the nose, mouth, and chin.

Exercises (471):

1. Name the two draping techniques used for dental patients.

2. What is the primary purpose of the routine drape?

3. What is used to hold the towel in position for the routine drape?

4. If the plastic-backed paper napkin is used for the routine drape, which way should the napkin's paper side be placed? Why?

5. When is the plastic apron particularly useful?

6. When is the surgical drape used?

7. What three purposes does the surgical drape fulfill?

8. Briefly describe how the surgical drape is applied.

472. State dental instrument preparation procedures, state when each method is preferred, and briefly describe the preparation procedure for each.

Select and Arrange Instruments. Once the dental officer has selected a procedure, you must furnish the necessary instruments. To do so, you must know what instruments the procedure requires and the ones the dentist prefers. Arrange the instruments in their order of use; this keeps you from having to search through all the laid out instruments for the one you want. Although many assistants merely lay the needed instrument on the bracket table, some dentists prefer that you use instrument packs or tray setups.

Packs. Although instrument packs are primarily used in oral surgery, they are often used in periodontic, endodontic, and restorative dentistry. The pack consists of a series of instruments and supplies that have been wrapped in a cloth wrapper and sterilized as a unit. The contents of the pack are planned so that almost everything needed for a specific operation is available in the pack. Medications and instruments, such as a dental handpiece that could be harmed by sterilization are not included in the pack. Using packs save you time and energy, because you won't have to gather the needed instruments and supplies one at a time.

Setup trays. Trays are like packs in that they have most of the supplies and instruments for an operation. Trays are different in that they let you prearrange instruments in their order of use. A typical setup tray is a corrosion-resistant, autoclavable tray that is sometimes compartmented. The tray's contents are usually covered with a cloth towel, surgical wrapper, or a suitable metal cover or lid. The entire tray, contents, and cover are then autoclaved as a unit. Setup trays are used after in the restorative section.

When preparing packs or setup trays, list the contents on a piece of autoclave tape, and place it on the outside. Write on the instrument pack or setup tray the date that the contents will no longer be considered sterile. Failure to label the packs or setup trays would cause you to have to open each one until you find the instruments you need. Normally, you do not need to list all of the contents on the label. It is enough to identify the contents by the procedure they are to perform. For example, silicate setup, amalgam setup, impacted mandibular third molar setup, gingivectomy setup, etc. Also, be sure that all instruments you place in the pack or on the setup tray are in good condition. Dull chisels, severely scratched mouth mirrors, and forceps or scissors with stiffly operating hinge joints should be remedied before placed in a pack or setup tray. Often more than one assistant will be assigned to a specialty section. It would be helpful to use a standardized selection and arrangement system for instrument packs. A itemized filecard or listing of the contents of instrument packs or setup trays will help prevent any misconceptions of their content by new people.

Exercises (472):

1. What must you know to select the instruments for a specific procedure?

2. List two ways in which you can prepare instruments for use.

3. How should you arrange instruments if you place them on the bracket table or in setup trays?

4. Where are instrument packs primarily used?

5. Describe the typical setup tray.

6. How should setup trays or packs be dated?

473. State the purpose of local anesthetics and given a list of specific items and procedures, identify their purpose.

Preparing the Local Anesthetic. Before doing a possibly painful dental procedure, the dental officer gives the patient a local anesthetic to make the operating site insensitive to pain. Your role in administering local anesthetics is to prepare the injection.

Preinjection items. Before giving the anesthetic, the dentist uses the following preinjection items to prepare the injection site: an antiseptic solution, a topical anesthetic, cotton-tipped applicators, and 2- by 2-inch gauze sponges. The gauze sponge is used to dry the injection site mucosa before applying the antiseptic and the topical anesthetic. The cotton-tipped applicator is used to paint the area with an antiseptic solution. Metaphen, a topical antiseptic, is commonly used. Another cotton-tipped applicator is used to apply the topical anesthetic. The topical anesthetic is usually supplied as an ointment. It is applied to reduce the pain associated with the injection of the needle. Your job during these preinjection procedures is to prepare the materials for use and to pass them to the dental officer as they are needed.

Injection items. The items used to give local anesthetics are: a *syringe*, a *needle*, and an *anesthetic carpule*. Since there are different types of each of these items, you need to know each type and how to prepare the right combination for your dental officer's use.

The dental injection syringe. The aspirating syringe (fig. 5-2) has a small harpoon on the plunger and a thumb ring handle. These two characteristics make the syringe easy to identify and helps the dental officer know whether the needle tip is in a blood vessel before injecting the anesthetic.

Because this is an aspirating syringe, the dental officer can inject the anesthetic without it going into a blood vessel. Once the harpoon is in the rubber stopper, the dental officer may then apply inward or outward pressure on the stopper by using the thumb ring handle and exerting either inward or outward pressure. Outward pressure produces suction; inward pressure pushes the anesthetia through the needle.

Before filling the syringe, always check the carpule for cracks or suspended articles. If you find any, discard the carpule and notify the dental and supply officers. Also, disinfect the carpule before loading it in the syringe. Placing the carpule (cartridge) in the aspirating syringe is fairly easy. Pull the plunger against the top part of the syringe body and place the cartridge in the slot located in the body part of the syringe. Now embed the harpoon in the loaded cartridge by holding the body portion of the syringe with one hand while lightly tapping the top of the handle with your other hand. (CAUTION: Do not tap the handle with too much force; this might cause the glass cartridge to shatter.) Until you are experienced in this, it is a good idea to wrap a towel around the body of the syringe to protect yourself from shattered glass. Be sure you use a sterile towel.

Injection needles. Almost all injection needles used by the Air Force Dental service are disposable, (See fig. 5-3.) and come in a variety of gauges and lengths. Those listed in the *Federal Supply Catalog* are in either 13/16- or 1 ⅞ -inch lengths, and have either 25- or 27-gauge openings. All of the disposable needles arrive in individual, sealed, plastic, capsulelike containers and are presterilized. Further, each of these needles has either a plastic or aluminum alloy hub designed to screw onto the threaded

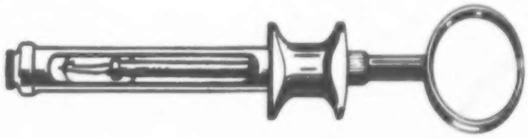


Figure 5-2. Aspirating syringe.

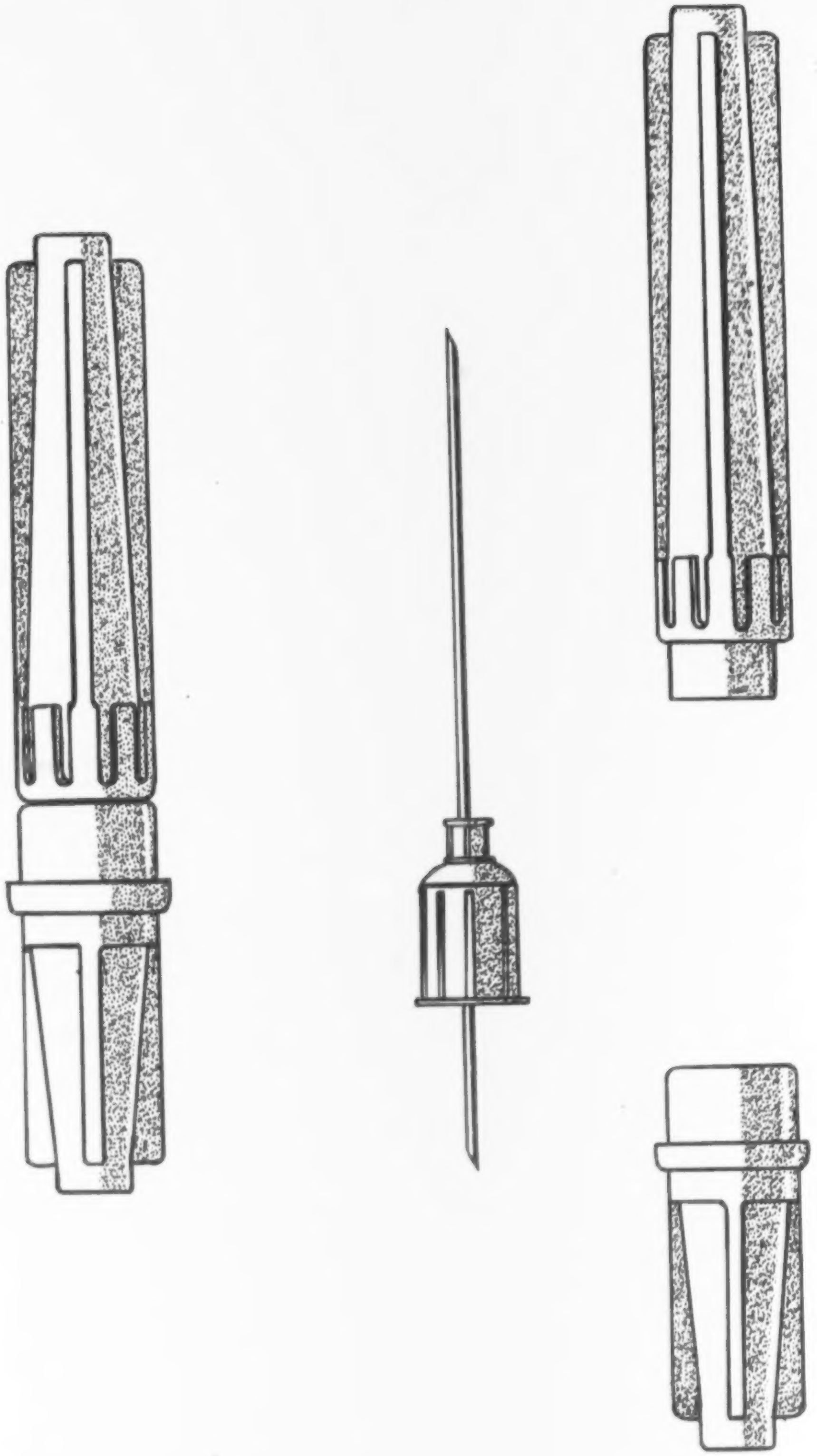


Figure 5–3. Injection needles.

end of the syringe. This hub lets the needle extend inward to penetrate the rubber seal portion of a loaded anesthetic cartridge and outward for injection into the patient. The plastic that encapsulates the sterile needle is easily slipped from both ends of the hub. When you place a needle onto the syringe, remove only the capsule part that covers the syringe. In this way, you keep the needle sterile until it is needed.

Carpules. You'll find many types of anesthetic cartridges in Air Force dental clinics. They are lidocaine hydrochloride, 2 percent, with epinephrine 1:100,000; lidocaine hydrochloride, 2 percent with epinephrine 1:50,000; mepivacaine hydrocholoride, 2 percent, with levonordefrin as a vasoconstrictor; and mepivacaine hydrochloride, 3 percent, without a vasoconstrictor. Each of the four types is sealed in a 1.8-cc glass cartridge or carpule. The needle end of each cartridge is sealed with a rubber membrane held in place by a metal band. The other end is sealed with a rubber stopper. Each type of anesthetic has a different colored rubber stopper. As you gain experience, you will be able to distinguish each type of anesthetic by its color. Figure 5-4 shows an anesthetic carpule. Having considered the necessary parts, let's see how they are assembled to make ready for an injection.

The dental officer will let you know which type of anesthetic, syringe, and needle he or she will use, and whether or not he or she will use a topical anesthetic. As a general guide, do the following when preparing for an anesthetic injection.

(1) Place on the bracket table the antiseptic solution, the topical anesthetic, two sterile cotton-tipped applicators, and a sterile 2- by 2-inch gauze sponge.

(2) Once you know which type of anesthetic syringe, and needle the dental officer wants, assemble them for the injection while the dental officer administers the antiseptic and the topical anesthetic.

When assembling these items, do so out of the patient's view. After you have checked the needles for barks, place the needle on the syringe (usually a short needle for maxillary injections and a long needle for mandibular injections), load the cartridge, embed the harpoon in the rubber stopper (when using the aspirating-type syringe), and force a small but visible amount of anesthesia through the needle to assure that all things are in readiness for the injection. Guard against contaminating the patient with infectious micro-organisms by using properly sterilized syringes, needles, and anesthetic cartridges. The syringes and needles should have been autoclaved or sterilized with dry heat, and the anesthetic cartridges should have been stored with the metal-banded end pointed downward in a 70-percent isopropyl alcohol solution. You should continue to guard against possible contamination by keeping the plastic needle covering in place until you pass the syringe to the dental officer. Naturally, this cover must be removed to check the syringe's operation and during the injection but should then be returned to its protective position. After each patient has been dismissed, you should bend and break or cut the needles to prevent further use. A destruction unit is available for disposable syringes and needles. You simply insert the needle into the unit's small orifice and squeeze the handles on the unit with a fast squeezing action. (See figure 5-5.) This shears the needle off at its hub so that it may not be reused.

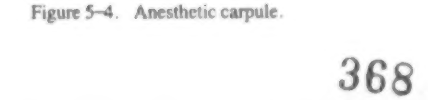


Figure 5–4. Anesthetic carpule.

Exercises (473):

1. What is the purpose of administering a local anesthetic?

2. In items 1 through 13 identify the purpose of the specific item or procedure listed in column B with the item or procedure listed in column A.

Column A

_____ (1) Short 13/16-inch needle.
_____ (2) Nonaspirating syringe.
_____ (3) Gauze sponge.
_____ (4) 1.8 cc glass carpule.
_____ (5) Metaphen.
_____ (6) Cotton-tipped applicators.
_____ (7) Topical anesthetic.
_____ (8) The syringe's harpoon.
_____ (9) Tapping the syringe's handle.
_____ (10) 70-percent isopropyl alcohol solution.
_____ (11) Vasoconstrictors.
_____ (12) Destruction unit.
_____ (13) Aspiration.

Column B

a. A commonly used topical antiseptic.
b. Used to dry the mucosa at the injection site.
c. Needle usually used for maxillary injections.
d. Used to apply the antiseptic or topical anesthesia.
e. Used to reduce the pain associated with the injection of the needle.
f. Contains the anesthetic.
g. Makes aspiration possible.
h. Employed to prevent reuse of the needles.
i. Assures that anesthetics are not injected into the blood vessels.
j. Epinephrine and levonordefrin.
k. Embeds the harpoon into the rubber stopper.
l. Characterized by a crutch-type handle.
m. Anesthetic carpules should be stored in this.

474. State the knowledges and procedures required to properly pass instruments and materials.

Pass Instruments and Materials. One of the most important duties of the chairside assistant is the passing and receiving of instruments and materials. To do this task you must know the routine of the procedures and the related

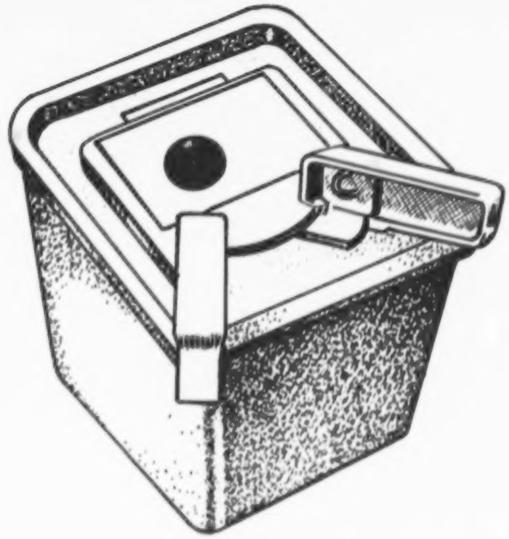


Figure 5-5. Needle destruction unit.

instruments and materials required. This lets you anticipate the dentist's needs and fulfill these needs without unnecessary delay. The position you work from depends on the dentist's desire and the treatment room arrangement.

Pass and receive instruments. Let's assume that you are standing on the left side of a patient who is being treated by a right-handed dentist. In most cases, you remove one instrument from the dentist's right hand and place the next needed instrument in his or her hand when given a signal. The signal may be a spoken word, a slight to moderate movement of his or her hand away from the patient's mouth, or only a pause in using the instrument. As the dentist gives a signal, remove the working instrument and pass the next needed instrument with the working end pointed toward the treatment area.

To begin the passing routine, you normally hold the instrument with you left hand in the position where the dentist may grasp it with his or her working hand without having to move the hand. Do not release your grip until the dentist has firmly grasped the instrument. The dentist will signal that he or she has finished with the working instrument and desires the next instrument. Since the instrument exchange and placement differs with various dentists, you should ask how the dentist would like to receive and exchange instruments. When you assist from the right side and in front of the patient, use your right hand in the same manner we described for the left hand above.

Prepare and pass materials. Dental materials must be prepared at the proper time. A material mixed too soon does not allow sufficient handling time. For example, an impression material mixed before the dentist is ready for it may harden or set in the impression tray before it can be placed in the patient's mouth. On the other hand, a delay in mixing an impression material on your part wastes time. Like results occur when there is a premature or delayed mixing of other dental materials. So, knowing when to mix is equally as important as knowing how to mix. As with instruments, knowing the routine of the procedure lets you anticipate when the dental officer will need the specific materials. You should have the mixing equipment ready and the material proportioned slightly prior to the time it is needed. Begin mixing only when you know the dental officer is ready.

When you are assisting during an amalgam restoration, load the amalgam into the amalgam carrier and pass the loaded carrier to the dental officer. You may sometimes use two or more amalgam carriers, which lets you fill the barrel of one while the dental officer is using the other. Of course, you must also pass condensing instruments during the amalgam restoration process. During the use of silicate and zinc phosphate cements, most dental officers prefer that you leave the mixed cement on the glass slab and then place the glass slab in an accessible place (on bracket table or on mobile cabinet top) or hold the slab with your hand. The dentist can then select the amount he or she desires. The overall idea in passing and receiving dental instruments and materials is to have the needed item at the right place, in the right position, and at the right time. In doing this, the dental officer is then free to concentrate more on the area of treatment.

Exercises (474):

1. What knowledges must you have to adequately pass instruments and materials?

2. What signals might the dental officer use to indicate he or she needs the next instrument?

3. How should you place the working end of the instrument you are passing?

4. What knowledge concerning materials is equally important as knowing how to mix?

5. What is the overall idea in passing and receiving dental instruments and materials?

475. State the purpose of retraction, list the instruments used, and indicate how much pressure should be applied when retracting tissue.

Retract Tissue. During many dental procedures, there is a need to retract oral tissues. Retraction is normally done to give the dentist easier operating accessibility, to allow a better view of the operation site, and to protect the tissues being retracted. The tongue, cheeks, lips, and gingiva are tissues which must often be retracted. As you recall, retractors are helpful in retracting gingival flaps and periosteal elevators may be used on gingival flaps and other oral tissues. The mouth mirror is very effective and is widely used to retract the tongue, cheeks, and lips. There are several medical-type retractors and a few of this type are sometimes used to retract oral tissue.

The main idea in retracting oral tissues is to firmly hold the tissue concerned out of the way, to permit better viewing and access to the operation site, and to protect the tissue being retracted. For example, the gingival tissues covering an impacted molar must be retracted to give visual and instrument access to the operation site. For another example, the tongue can become very unruly in some patients and must be protected from possible harm by rotating burs and other sharp instruments. Likewise, sometimes the cheeks must be retracted for protection, as well as to permit access to certain areas of the mouth. During surgical operations to remove salivary stones from the sublingual glands, you may need to retract a flap of the oral mucosa with one hand and manipulate an aspirator tip with the other. In such cases, the dental officer also may need to retract the tongue with one hand and perform the operation with the other. Whatever the case may be, remember to retract the tissue firmly enough to prevent slippage, but not so firmly as to cause unnecessary tissue bruises and trauma. An unfirmly applied retractor tends to result in slippage and unnecessary tissue damage.

Exercises (475):

1. State the purposes of retraction.

2. List the instruments that are used to retract the various tissues.

3. How much pressure should you apply to the tissue you are retracting?

476. Identify the types of irrigation and aspiration equipment.

Irrigation and Aspiration. The dentist usually will leave it up to you to irrigate the oral cavity. By applying water or saline solutions to operating areas in the oral cavity, you bring small tooth particles, dried blood, and other debris into solution so that you can remove them by aspiration. This leaves the dentist a clean field of operation. Due to handpieces with water spray systems, dental assistant no longer have to do much irrigation during restorative procedures. But sometimes the dental officer may need additional irrigation, or he or she may decide not to use the water spray system for a particular procedure. In these cases, use the dental unit mounted water syringe to irrigate the operative site.

When you irrigate operation sites during surgical procedures, you normally use a sterile saline solution or sterile water as the irrigation medium. You may apply these fluids by using either a bulb-type or Luer (piston-barrel) syringe. The main purpose for irrigation during surgical procedures is to keep a clean field of operation. The cleansing is not completed, however, until the irrigating solution is aspirated (drawn by suction) from the mouth.

Aspiration is necessary to remove blood, pus, saliva, and debris from the filed of operation and the oral cavity. In Air Force dental clinic this is done in one of three ways: by using the saliva ejector, the oral evacuator, or the Gomco aspirator. When using any of these aspirators, always place their tip in the upright position before turning them off. This helps prevent materials from logging their hoses.

Saliva ejector. Your role when the saliva ejector is to be used is to make sure that a sterile saliva ejector tip is in place for each patient. The saliva ejector is used when the procedure needs for the saliva is to be removed at a slow rate of speed. The saliva ejector does not have enough suction power to remove large volumes of solutions from the oral cavity. This aspirating device is widely used, however, to remove salivary secretions after the cavity has been prepared and during the placement of filling materials in the cavity preparation.

Oral evacuator. The oral evacuator is generally described as a high-volume, low-pressure suction apparatus. That is, the oral evacuator can remove a high volume of fluids from the oral cavity without exerting injurious suction pressure to oral soft tissues. These qualities make the oral evacuator an almost ideal suction apparatus for removing the relatively high volume of fluids that accumulate during cavity preparation. Your role in handling the oral evacuator is to frequently manipulate the suction tip, to aspirate the oral fluids, and to assure that a sterile tip is in place for each patient. You also must clean and maintain the oral evacuator as instructed in the manufacturer's maintenance pamphlet.

Gomco aspirator. The Gomco aspirator is primarily used during periodontic and oral surgical procedures. The small aspirating tips are especially helpful in removing debris, blood, and fluids from tooth sockets during attempts to locate and remove root tips. The suction ability of the Gomco aspirator is better than the saliva ejector, but less than that of the oral evacuator. An important part of your role concerning the Gomco aspirator is to assure the sterility of the aspirator handle and the aspirator tip for each patient. When operating this aspirator, keep a close watch on the reservoir bottle to make sure it doesn't overflow. After each use, empty and clean the reservoir bottle, flush the tubing with water, remove and sterilize the aspirator handle and tips, and disinfect the latex tubing. Follow the manufacturer's instructions concerning other maintenance requirements for this piece of equipment.

Exercises (476):

1. What is the purpose of irrigation and aspiration?

2. What type of irrigation media is normally used for restorative procedures?

3. List the irrigation media used for surgical procedures.

4. Differentiate between the types of irrigation and aspiration equipment by matching the descriptive statement in column B to the equipment in column A.

Column A

_____ (1) Gomco aspirator.
_____ (2) Saliva ejector.
_____ (3) Oral evacuator.
_____ (4) Bulb-type or Luer syringe.
_____ (5) The unit's water syringe or spray system.

Column B

a. Used for irrigation during surgical procedures.
b. Its low suction power limits its use mostly to removing salivary secretions.
c. Used for irrigation during restorative procedures.
d. Ideal for removing large volumes of solutions from the oral cavity.
e. Primarily used for aspiration during surgical procedures.

477. Define the word "culture" and specify culture preparation procedures.

Preparing Cultures. While culture preparation is not frequently used in all dental specialties, it is an important task nevertheless, and is used most frequently with endodontics (root canal therapy) and dental surgery (oral surgery and periodontal surgery). For our purpose, the word "culture" means to gather a sample of micro-organisms from a patient and to promote the growth of these micro-organisms.

To prepare a culture, you need to follow some definite steps in their proper sequence. Basically, these steps involve gathering a sample of micro-organisms, placing the sample in or on a suitable culture media, carefully labeling the sample, incubating the sample, and finally evaluating the culture. Some of these steps are done by the dental officer, some by you, and some by the medical laboratory. Let's take a closer look at them.

Micro-organism sample. In the endodontic section, a sample of root canal micro-organisms is taken by inserting a sterile paper point into the root canal. The contaminated paper point is placed in a culture medium contained in a test tube, and the tube is then sealed. Micro-organism samples from dental surgery sites are usually acquired by swabbing the site with a sterile cotton-tipped applicator. The sample is then placed in a test tube and sealed to prevent further contamination until the sample can be placed on a culture media.

Flame the opening of the test tube upon opening and adjust before sealing it. To flame the opening of the test tube, tilt it slightly and hold it over a lighted Bunsen burner. Flaming destroys micro-organisms that may be found near the opening of the tube. This is very important because it helps prevent introducing micro-organisms other than those taken in the sample.

Culture media. Culture media for promoting micro-organism growth in endodontic cases are usually in solution form. Two common solutions used are penase ascites and glucose ascites. These solutions appear mostly clear with a slightly yellow tint. The glucose ascites is suitable for rapid growth of many types of micro-organisms, but is more commonly used with root canal samples that have been treated with camphorated parachlorophenol. In contrast, the penase ascites is specially formulated for use with samples from root canals that have been treated with penicillin. Beef broth gelatin is sometimes used as a culture medium also.

Labeling. Once the sample of micro-organisms has been sealed in the test tube, you must complete and label the tube. There is no one standard label for this purpose. Any label that can be easily attached to the test tube and provide the following information is suitable:

- Patient's name.
- Date and time of sample taken.
- Whether it is the first, second, etc., culture taken.
- Description of sample (root canal, abcess, etc.).
- Type of report desired.

For endodontic purposes, a report that states positive or negative is sufficient. For dental surgery reports, however, the dental officer may desire information as to the exact type or types of micro-organisms found. When cultures are forwarded to the medical laboratory, they should go with an SF 557, Miscellaneous.

Incubation. For the micro-organisms to grow properly, they must be subjected to culture incubation temperature (37° C or 98.6° F.). This temperature is attained and maintained in special incubators (small ovens) usually found in Air Force medical laboratories. Usually, a sample of micro-organisms introduced to a suitable culture medium will show signs of growth within 48 hours of subjection to the incubation temperature.

Evaluation. In most cases medical laboratory personnel handles this step, but for endodontic procedures, sending the sample to the laboratory, is not always necessary. The only report needed for most endodontic cases is that there is (positive) or is not (negative) visible evidence of microbial growth in or on the culture medium. A cloudy ascites solution is positive, and visible moldlike growth on a gelatin medium is likewise positive.

Exercises (477):

1. Define the word "culture."

2. How are cultures taken?

3. What should you do upon opening the test tube just prior to sealing the tube?

4. What type of culture media is commonly used with root canal samples which have been treated with penicillin?

5. What data should be included on the label you attach to the test tube?

6. What type of report is sufficient for endodontic purposes?

7. What incubation temperatures are necessary for cultures to grow properly?

8. How soon should growth be apparent after a culture has been introduced into the incubation media?

9. How does a positive growth structure appear in the gelatin and ascites mediums?

478. State procedures for dismissing a patient.

Dismiss the Patient. Once the dentist is through, your final task is to dismiss the patient. While doing so, remain as cordial, pleasant as you were when you greeted the patient. This will leave the patient with the feeling of having received the finest treatment possible.

The first step in dismissing a patient is to remove all debris from his or her face. Better still, hand the patient a hand mirror and a dampened towel and let him or her do it. You may then remove the drape, apron, or protective napkin from the patient. Also, be sure to push the dental operating light and the bracket table to an out-of-the-way position. Further still, you might need to lower the dental chair and move the chair backrest forward, making exiting easier. If the patient brought personal items (such as spectacles) and left them in your care, make it a point to see that he or she doesn't leave them behind. Should the patient need a further appointment, make sure that the appropriate arrangements are made. Although the patient treatment is over, you still have a few more tasks, such as completing your administrative duties and preparing for the next patient.

Complete administrative duties. In most cases you can do your administrative tasks as breaks in your chairside assisting dictate. But with some dental treatment procedures you have to assist the dentist throughout the treatment. In such cases, it is best to complete the dental treatment forms before the patient has been dismissed. This allows the patient to return his or her record to the front desk for any further appointments. Don't put off completing these associated administrative tasks, because you may forget some of the specifics involved.

Store materials, clean, and sterilize instruments. This step is critical in preventing the contamination of the next patient. You need to put back in proper order all medications and materials used during the patient's treatment. Also, scrub with soap and water and throughly rinse and dry the instruments used in the operation. Sterilize the cutting-type instruments in a dry heat sterilizer and the remaining instruments in the autoclave.

Clean and disinfect equipment. Sometimes the cuspidor and dental units are splattered with debris after patients rinse their mouths. Such debris is sure to be spotted by the next patient, you need to remove it. To maintain professional standards, you must not only remove the debris to provide a clean appearance, but you also must disinfect the area with a solution such as isopropyl alcohol. Also, use a sponge (2- by 2-inch gauze sponge dipped in an approved disinfectant) to disinfect all other equipment items used or touched during the last treatment session. Items on the dental unit that are frequently used include the air syringe, the water syringe, handpieces, and the dental operating light handle.

Obtain additional needed items. After you have dismissed the patient and restored the treatment room to its original order, you must get any additional equipment or supplies needed for the next operation.

Exercises (478):

1. Briefly describe the steps involved in preparing the patient to leave the treatment room.

2. When should you complete the necessary administrative tasks?

3. After the patient has left and you have finished the administrative procedures, what must you do to restore the treatment room to its original order?

4. What remains to be done after you have restored the treatment room to acceptable order?

479. State procedures for managing dental treatment room supplies.

Management of Treatment Room Supply Levels. As a chairside assistant, you also are responsible for maintaining the supplies used in dental treatment rooms. These supplies include both patient treatment supplies and the administrative forms used to record patient treatment. In carrying out the duty, you will have to inventory, order, turn-in, and store the dental supplies for the dental treatment room. Let's consider these elements one at a time.

Inventory. Inventories are critical if dental treatment rooms are to run smoothly. Taken daily for best results, they insure you always have the supplies needed to handle the daily schedule of patients. They also help prevent an excess of material on hand. Depending on what you find each day, adjust your stock levels by turning in or ordering supplies.

Ordering supplies. Because procedures for ordering dental supplies vary from base to base, check with local dental supply personnel for the appropriate procedures. When ordering, always practice good supply management. Order only a working level of supplies—don't hoard. Hoarding deprives others of the supplies they need, encourages thievery, ties up supply dollars needlessly, and may cause the lost of some items due to deterioration. When ordering dental supplies, consider also what types of items are needed. When you submit your order, be sure you have included both the replacement and new items needed for patient treatment. Of course, emergency supply requirements can be filled at any time.

Turning in supplies. In doing your daily inventories, report all overages to dental supply personnel or to your NCOIC so that further distribution or turn in steps can be taken.

Storing supplies. Proper storage of dental supplies is also your responsibility. Proper storage simply means that you take whatever steps necessary to protect the supply items. This means keeping bottles tightly closed, keeping older items in front so that they will be used first, and storing only enough of each supply item to last for a few days. Also, remember to keep items such as hydrogen peroxide stored in a cool, dark place; keep certain drugs and precious metals under lock and key; and take any other steps necessary to protect supply items.

Exercises (479):

1. List the elements involved with dental treatment room supply management.

2. Why is it important to inventory supplies?

3. How often should you inventory your treatment room supplies?

4. Why is it important not to hoard supplies?

5. Why should you turn in supplies that your inventory shows as excess?

6. What does the proper storage of supply items basically entail?

5-3. Four-Handed Dentistry

Today's dental profession must increase its productivity to keep up with the dental needs of our growing population. Today's dentists must treat many more patients than the dentists of the past. The obvious solution is to produce more dentists. But this has proven more difficult than it seems. It requires additional dental schools, expansion of existing schools, considerable more money, and more people interested in a career in dentistry. Another obvious solution is to increase the productivity of the dentists currently in practice. This solution kindled the birth of four-handed dentistry. Four-handed dentistry, as it has been developed, not only increases productivity but reduces stress and fatigue on the operator and his or her assistant.

480. Identify the guidelines suggested for implementing the four-handed dentistry concept.

Guidelines of Four-Handed Dentistry. Four-handed dentistry, as the name implies, uses the hands of the dentist and the assistant maximum. In implementing four-handed dentistry, there are five guidelines to follow:

(1) Both the dentist and the assistant should work from a seated position.

(2) The patient should be placed in the supine position.

(3) Operating equipment should be positioned for the convenience of both the dentist and the assistant.

(4) The dentist should keep his or her hands and eyes in the operating zone.

(5) All routinely performed operations should be routinized.

Exercises (480):

Identify the guidelines that apply to four-handed dentistry by indicating whether the following statements are true or false (T or F). If you answer false, state why.

_____ 1. The dentist should keep his or her hands and eyes in the operating zone.

_____ 2. The assistant should work from a standing position.

_____ 3. The operating equipment should be positioned solely for the convenience of the technician.

_____ 4. All routinely performed operations should be routinized.

_____ 5. The patient should be placed in the supine position.

481. Given several equipment designs, identify those that are best suited for four-handed dentistry.

Equipment. The selection and positioning of four-handed dentistry equipment is very important. Since the operator and assistant are both working from a sitting position, the equipment design must be somewhat different from that for conventional dentistry. Let's look at some of the recommended equipment for four-handed dentistry.

Operating stools. Stools for both the dentist and assistant should be well padded and comfortable. They must be mobile and have a broad base to give stability. Normally, chairs with at least five casters are preferred. The stools should have a foot-support ring so that the user can keep his or her feet parallel to the floor, thereby maintaining comfort and posture. Also, the stool must have a body support that can be used for either the abdomen or back.

Dental operating chair. The chair should have a thin, narrow back. Chairs with bulky backs make patient positioning difficult and also keep the dentist and assistant from getting into a comfortable working position. The chair should provide complete body support for the supine patient and have independently powered back and seat controls, which can be conveniently adjusted by either the dentist or the assistant. The chair design should permit rotation for better patient positioning. It also should have a low base so that the chair can be lowered to within 14 inches of the floor.

Dental unit. The unit should be designed so that it is compact and doesn't occupy space needed by the assistant. Hose-attached instruments, such as the handpieces, syringe, and oral evacuator, should be conveniently positioned to both the dentist and the assistant. The most noticeable difference between this unit and the conventional unit is the absence of the cuspidor on the four-handed dentistry unit. The syringe should be the multipurpose three-way type, which supplies air, water, and spray.

Artifical lighting. A ceiling track-mounted light is ideal for four-handed dentistry. It should be easily adjusted by either the dentist or the assistant. If a track-mounted ceiling lighting is impractical, chair- or unit-mounted lighting may be used. Ceiling track-mounted lighting is preferred, however, because it is more flexible and does not have mounting attachments that could get in the way of the dentist or the assistant.

Cutting equipment. Ideally, you should have a slow-speed handpiece and two or more high-speed handpieces. Having an adequate number of handpieces eliminates the loss of time previously experienced for changing burs. All handpieces should be controlled by a single, variable-speed foot control. The foot control should be the straight-line depression type rather than the rotation type. This lets the operator keep his or her foot in one position for better control and comfort.

Cabinets. Don't crowd the treatment room with unnecessary cabinets. Normally, a few wall-mounted cabinets are enough to store needed supplies. There should be two sink-top cabinets, one for the dentist to wash his or her hands, and one for the assistant to wash his or her hands and to clean instruments. Two units save time because neither person has to wait for the other. There also should be a specially designed mobile cabinet to provide easy access to the supplies and equipment needed during the patient's treatment. It also should provide a working surface over the assistant's lap and be of a height comfortable for the sit-down assistant.

Setup trays. There should be an adequate number of setup trays. As mentioned before, these trays contain prearranged sterilized instruments and materials for specific procedures. There also must be storage space for these trays. A good idea is to color code the trays with tape; for example, blue for amalgam, red for silicate, yellow for gold, etc. Instruments also may be coded to identify them as a part of a particular tray setup.

Exercises (481):

From the equipment designs listed below, select the design features best suited for the four-handed dentistry concept by placing a checkmark in the space provided.

1. Operating stool

_____a. Equipped with foot support ring.
_____b. Has less than five casters.
_____c. Is immovable and has a narrow base.
_____d. Has a body support that can be used for either the abdomen or back.

2. Dental operating chair

_____a. Has a low base so that it can be lowered to within 18 inches of the floor.
_____b. Base permits rotation for better patient positioning.
_____c. Provides complete body support for supine patients.
_____d. Has thick, broad, well-padded backrest.
_____e. Has independent positioning controls that can be operated by either the dentist or technician.

3. Dental unit

_____a. Has a multipurpose syringe.
_____b. Has a compact design.
_____c. Has hose-attached instruments conveniently positioned for both the dentist and technician.
_____d. Is not equipped with a cuspidor.

4. Artifical lighting

_____a. Should be unit mounted.
_____b. Should be easily adjusted by either the dentist or technician.

5. Cutting equipment

_____a. All handpieces controlled by a single variable-speed foot control.
_____b. Has rotation-type foot control.
_____c. Is composed of a slow-speed handpiece and two or more high-speed handpieces.

6. Cabinets

_____a. Mounted cabinets should provide sink-top cabinets for both the dentist and the technician.
_____b. The mobile cabinet should provide a working service over the assistant's lap.

7. Setup trays

_____a. Should never be color coded.
_____b. Should contain prearranged, sterilized instruments and materials for specific procedures.

482. State the proper operating positions for four-handed dentistry.

Operating Positions. Once the patient has been seated, the dentist and the assistant should place themselves in the proper positions for treatment. These positions can be best understood by relating them to a clock (fig. 5-6). The dentist's stool should be in the 8- to 11-o'clock position, and the assistant's stool should be in the 2- to 5-o'clock position. Instruments and materials are passed in the transfer zone. The static zone is basically an area of no activity.

The dentist should sit with his or her back straight and head relatively erect. This helps prevent curvature of the spine. The dentist's shoulders should be parallel to the floor and his or her elbows close to his or her sides. The patient should be lowered to a position that places the field of operation as close to the dentist's elbow level as possible. The dentist should further position himself or herself so that the patient's mouth is in line with his or her sagittal body plane. When the patient is properly positioned, the dentist's eyes should be 14 to 16 inches from the operating site.

As the assistant, you should sit as close as possible to the backrest of the patient's chair with your feet directed toward the head of the chair. This position lets you reach the field of operation, hose-attached instruments, and the instruments and materials from the mobile cabinet without leaning, twisting, or overextending your arms. You should adjust your stool so that your eye level is 4 to 6 inches above the dentist's eye level. And, like the dentist, you should sit in an erect position. The mobile cabinet should be

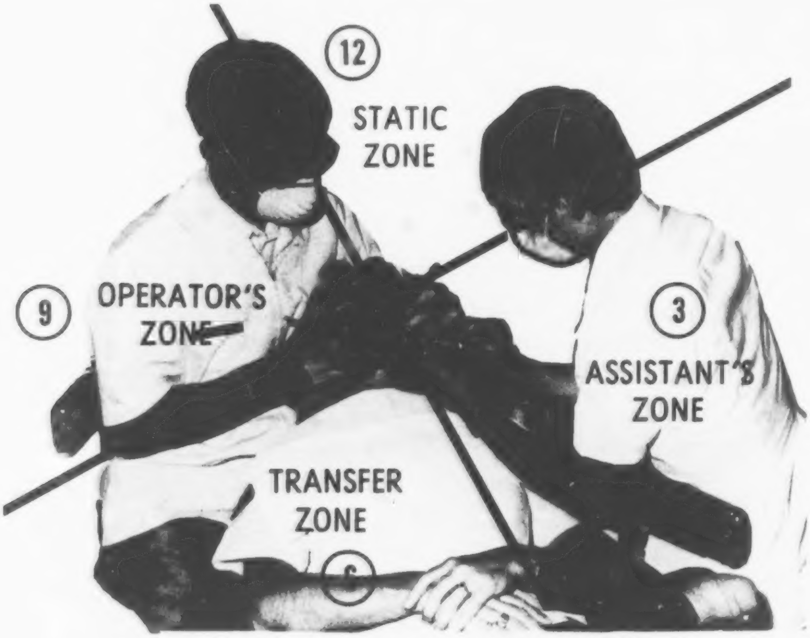


Figure 5–6. Operating positions.

placed toward the head of the chair and so positioned to allow you easy access to the needed instruments and materials.

Exercises (482):

1. As related to the face of a clock, in what zones should the dentist's and assistant's stools be positioned?
2. In what zone are instruments and materials passed?
3. To what level should the patient be lowered?
4. When he or she is properly positioned, how far from the operating site should the dentist's eyes be?
5. How should the assistant's eye level be in relation to that of the dentist?
6. Where should you position the mobile cabinet?

483. State appropriate assisting techniques for four-handed dentistry.

Assisting Duties. As we discuss the assisting duties, keep in mind that the prime objective of four-handed dentistry is to increase production while reducing stress and fatigue to the operator and assistant. This demands that the dentist and the assistant work as a well-knit team. Their two heads and four hands must function together toward a common goal. As a result, you as the assistant are more involved in the patient treatment. This, of course, means that you must fully know the treatment routine and have each instrument and material ready at the proper time. Also, the absence of the cuspidor means that you must aspirate throughout many phases of the procedure. Let's first discuss aspiration.

Aspiration. The reason a cuspidor isn't used in four-handed dentistry is that is eliminates the time lost when the patient expectorates. Since the patient doesn't expectorate, you must aspirate throughout the procedure. Hold the aspirator tip in a position where it adequately evacuates saliva, debris, and water spray from the handpiece. Position it so that it doesn't interfere with the dentist's line of vision or access to the operating site. Normally, you aspirate with the right hand and transfer instruments with your left hand.

Instrument transfers. Since your right hand is busy aspirating, you must learn to transfer instruments with you left hand. The one-hand instrument pass may sound difficult at first, but it is quite easy to master. Let's assume that the dentist is using instrument "A" and you know that he or she will soon need instrument "B." You pick up instrument "B" by the end opposite from the working end, and hold it between your thumb and first two fingers. Hold the instrument close to the field of operation and parallel to the instrument being used. The dentist gives you the signal he or she is ready for instrument "B" by raising instrument "A" from the tooth. Now you take instrument "A" between third and small finger of your left hand, remove it from the dentist's hand and replace it with instrument "B."

Other duties. If your unit has two high-speed handpieces, you should place the first cutting bur the dentist needs in one handpiece and the second bur in the other. This eliminates lost time from having to change burs. The other assisting duties, such as mixing materials and completing the administrative tasks, remain basically the same. The more you are involved with four-handed dentistry, the more you'll see ways to improve your routine.

Routinizing. To make the most of the four-handed concept, you must be able to properly anticipate the dentist's needs. To do this, you must know the treatment routine. It also is important that where possible, you have a set routine for every operation. Then you must systematically follow that routine. Once you have done this, you and the dentist can do more procedures and be less fatigued at the end of the workday. There also will be a higher quality of dental treatment.

Exercises (483):

1. Why must you spend more time aspirating during a four-handed dentistry procedure?

2. What is gained by the elimination of the cuspidor on the four-handed dentistry unit?

3. How should you position the aspirator tip?

4. How does the four-handed dentistry concept alter your instrument-passing technique?

5. How can you eliminate much of the time lost in changing burs?

6. What must you have knowledge of to properly anticipate the dentist's needs?

CHAPTER 6

Specialty Assisting Procedures

A TYPICAL Air Force dental clinic has several specialty sections. Each of these sections provides a special kind of dental treatment. To illustrate, let's compare a dental clinic to a modern department store. Unlike past "general merchandise stores," where you could get all needed articles from one small room or building, the modern department store has several specialty departments or sections. Today if you need a shovel, you go to the hardware department, or if you need shoes, you go to the footwear department. Likewise, in Air Force dental clinics, examinations are done in the examination and treatment planning section, and teeth are pulled in the oral surgery section. You may be assigned to assist in any one or all of the specialty sections during your Air Force career.

To be an effective assistant, you must know what procedures are done in each of the specialty sections, and you also must be able to do the proper assisting techniques. Although the basic assisting procedures have been covered in Chapter 5, the various specialty sections have some additional requirements. This chapter covers the individual specialty sections and your role in these sections.

6-1. Examination Section

A dental examination is one of the basic professional services provided by the Air Force Dental Service. The time, skill, and effort required to do and record a dental examination is as important as those for any other dental procedures.

484. State the functions of the examination and treatment planning section and specify the assisting procedures required in this section.

Examination Section Procedures. There are several different functions or procedures done in the examination section. These functions include:

- Scheduled periodic examination of military members.
- Examination of sick call patients and the routing of such patients for immediate treatment when necessary.
- Treatment planning for members eligible for care.
- Special examination in support of the medical mission.

Period examination. Probably the most frequent purpose for administering a dental examination is to meet the periodic examination requirement. To facilitate the accomplishment of these periodic examinations, consolidated base personnel offices furnish the dental services and organizational units with machine rosters. These rosters are made up according to organization and date of last examination. Each unit coordinates the scheduling of the dental examinations with the dental services and sends an annotated notification card to the unit's members to advise them when to report for the examination. The records of persons who have transferred should be removed from the file and disposed of according to appropriate directives.

Dental sick call. Another important function of the examination section is the examination and routing of sick call patients. The purpose of the sick call examinations is to diagnose the patient's dental problem and to route him or her to the appropriate treatment section. Many of the people who report to dental sick will need immediate treatment because of the severity of their pain; others, of course, will not require such prompt action. An example of a patient needing immediate attention is one with a painful acute periapical abscess. You would send this patient immediately to the examination section. This section will diagnose the condition and refer the patient to either the oral surgery or endodontic section for immediate treatment. The section also may order radiographs. For those sick call patients who don't need immediate attention, say a person who has lost a restortation and is not in any pain, the examination section will simply diagnose the condition and schedule the patient for an appointment with the restorative dentistry section.

Treatment planning. A treatment plan is developed to provide a systematic approach to clinical dental care. The first step in developing a treatment plan is to record the findings of a thorough examination, including the condition of the oral and adjacent tissues, diagnostic measures, and consultations required. The treatment plan also may include the following: emergency treatment; treatment to prevent early development of emergency conditions; initiation of treatment of periodontal and other soft tissue disease; individual instructions and motivation in toothbrushing, diet, eating habits, and other self-care measures; a thorough prophylaxis, with consideration given to the use of a prophylaxis paste containing stannous' fluoride or a topical application of stannous fluoride solution; correction of gross discrepancies of occlusion; exodontia and other necessary oral surgery; restoration of carious tooth structure; and preparation of the mouth to receive prosthetic appliances.

Special examinations. Dental examinations in conjunction with medical physical examinations may be requested for a number of purposes. These include, but are not limited to, examinations required for enlistment, commissioning, remote or isolated duty, flying training, enrollment in the Air Force Academy, and assignment as a food handler. Normally, the type of dental examination required is indicated on the patient's physical examination form. If it is not indicated, you should find out the purpose of the examination and refer to the foldout located in the back of AFR 162–1, *Management and Administration of USAF Dental Activities*. This foldout tells you the type of examination required, the forms involved, the dental standards the patient must meet, and any other special requirements.

Examination Assisting Duties. You will spend most of your time in the examination and treatment planning section completing forms. For this reason, you must have a thorough knowledge of the types of examinations, charting symbols, diagnostic nomenclature, authorized abbreviations, and dental classifications. You also must do the basic assisting procedures, such as receiving and seating the patient, selecting and arranging instruments and medications, and coordinating patient needs with other sections.

Your behavior is critical in the examination and treatment planning section because this is where a patient is first exposed to the professional treatment area of the dental clinic. The old adage "The first impression is a lasting impression" is the point in question here. By being cheerful, courteous, prompt, and thorough, you help create the desirable first image of Dental Services on your base. Make sure that none of your patients are overlooked when their needs are to be coordinated with other sections. By following up on the patient, you can prevent such problems.

Exercises (484):

1. What is the functions of the examination section?

2. What is probably the most frequent purpose of administering a dental examination?

3. What is done during sick call examinations?

4. What is the purpose of treatment planning?

5. To what publication should you refer if you are trying to determine the type of dental examination required by an applicant for flying training?

6. What will you spend the majority of your time doing as part of the examination and treatment planning section?

7. Why is your behavior in the examination and treatment planning section extremely critical?

6-2. Restorative Section

Since the heaviest workload in any dental clinic is restorative dentistry, most dental specialists are assigned as restorative assistants. Restorative dentistry (operative) includes the treatment and restoration of carious teeth with metallic and nonmetallic restorative materials. These materials are usually amalgam, silicate, resins, and gold. If the dental assistant is well trained and works closely with the dental officer, the patient may receive more treatment in a shorter length of time. Let's first discuss restorative procedures, followed by restorative assisting duties.

485. State the function of the restorative section and specify the assisting procedures required in this section.

Restorative Procedures. The restorative dentistry section strives to restore decayed or fractured teeth to their original functional ability and esthetic quality of healthy dentition. In general, restorative procedures include the following:

- Determining the procedure(s) to be accomplished.
- Administering anesthesia.
- Preparing the cavity or cavities to be filled.
- Placing filling material(s) into prepared cavities.
- Carving and finishing restorations.
- Smoothing and polishing restorations.

All of the above procedures are the primary responsibility of the dental officer. Your role in restorative dentistry is to help the dental officer complete each step.

Restorative Assisting Duties. After you have seated the patient, don't forget to maintain light conversation until the dental officer arrives. Since patients sometimes have identical names and ranks, you should check with them to make sure you have the right treatment record. Sometimes the only difference between records in such cases is the SSANs. After checking the record with the patient, place it where it will be convenient to the doctor. The radiographs and the treatment records should be out so the doctor can view them when he or she arrives. This arrangement reduces error and saves time. The patient should now be comfortable in a preoperative position.

When the doctor arrives, wash your hands and dry them in full view of the patient. The patient is then further impressed with the idea of cleanliness and sterility. Then remove the instruments for the examination or operation from the cabinets and lay them out in the arrangement and location from which they are used. It is best to set out only the instruments that are going to be used on each phase of the procedure. This keeps the instruments from getting cluttered and helps keep the patient from becoming apprehensive. If the saliva ejector is to be used, attach a sterile tip to the dental unit after the patient has been seated. This assures the patient of the cleanliness of the saliva ejector apparatus. Do not hang the instruments over the edge of the bracket table; they are easily dropped from this position. Turn on the operating light and adjust it to the operating field as the dental officer approaches the patient.

After the dental officer has decided which tooth or teeth to restore, the next step is to administer the anesthesia. Do your share of these duties out of the patient's view. When the dental officer is ready to proceed with the injection, pass the gauze sponge to wipe the injection site. Receive the sponge and pass the cotton-tipped applicator. While the dental officer is administering the topical anesthetic, loosen the protective cover from the needle. Hold the syringe by the barrel so that the handle may be passed to the dentist. Receive the cotton applicator and pass the syringe. As the dentist receives the syringe, remove the protective cover from the needle. After the injection, replace the protective covering on the needle to insure safety.

After the preliminary preparations, the actual treatment begins. If you are well prepared, the operation should proceed smoothly without delay, and the patient will be more at ease and confident. Watch closely during the operation and be ready to hand the instruments, materials, and medications to the doctor as they are needed. Immediately remove those instruments that are no longer required. Keep a clear field of vision for the dentist by retracting the cheeks or tongue and irrigating and aspirating as required.

Mix and pass restorative materials by following the procedures we mentioned earlier—namely, exercising care to mix at the right time and following the manufacturer's instructions. Once the restorative materials have been placed in the cavity, the dental officer then begins the carving and finishing of the restoration. The dentist does not normally require assistance at this time. You may then make good use of this "free" time by doing the forms and records that reflect the patient's treatment.

Once the operation is over, you are expected to begin your postoperative duties. If future appointments are needed, make sure that the patient knows how to arrange for them. Dismiss the patient in the same cordial, pleasant manner that you greeted him or her. You may then remove all instruments laid out for the operation. Wash and sterilize these instruments regardless of whether or not they were used. Return the medications, materials, and equipment to their proper places and prepare the chair and cabinet for the next patient.

Exercises (485):

1. What is the function of the restorative dentistry section?

2. What should you do after you have seated the patient and are waiting for the dental officer to arrive?

3. What procedures should you perform between the time that the dental officer enters the treatment room and the time that treatment begins?

4. Why should you replace the protective covering on the anesthetic needle after the injection has been completed?

5. How do you maintain a clear field of vision for the dentist during the restorative procedure?

6. When is normally a good time to complete the forms and records that reflect the treatment the patient has received?

7. When you are performing your postoperative cleanup, what should you do with instruments that were laid out for the procedure but were not used?

6-3. Oral Surgery Section

Oral surgery deals with the surgical treatment or correction of diseases, defects, or injuries of the oral cavity, teeth, and adjacent tissues. In this section on oral surgery, we cover the common oral surgery procedures and your responsibilities during these procedures.

486. Identify the various procedures performed in the oral surgery section.

Oral Surgery Procedures. To start our discussion of the oral surgery section, let's define some of the common oral surgery procedures:

Extractions. The removal of erupted, diseased, or malposed deciduous and permanent teeth.

Retained root removals. The removal of retained roots that may be buried in the bone and not visible in the oral cavity. Retained root tips may be present due to fractured teeth, advanced decay, or any imcomplete postsurgical procedure. They are usually detected on radiographs.

Surgical removals. The removal of impacted, embedded, or partially erupted teeth involving tissue incision, excision, or bone removal. Removal of unerupted third molars is the most commonly performed surgical removal.

Alveolectomies. The removal of the alveolar bone. This is usually done in conjunction with a surgical removal or multiple extraction (1) to eliminate sharp bone edges that could cause discomfort to the patient and (2) to provide suitably contoured bone structure for denture fabrication and insertion. At times, however, this may be an independent procedure to prepare past extraction sites for dentures.

Cystectomies. The removal of cysts and periapical granulomas.

Tori removals. The removal of abnormal, bony growths, which are often found on the lingual surface of the body of the mandible or the center of the hard palate. Usually tori removals are done to permit fabrication and insertion of dentures.

Frenotomies. The surgical removal of that tissue which restricts movement of the tongue (lingual frenum) or lips (labial frenum). The excision of the lingual frenum is done to help correct tongue tie. The labial frenum may be done to enable better lip movement and to help prevent large diastemas (spaces) between erupting central incisors.

Biopsy. The removal of a piece of tissue from a living subject for diagnostic and microscopic examination.

Foreign body removals. The removal of any foreign body, such as a needle, metallic restoration piece of elevators, piece of forceps, or gunshot. Such a removal is considered a surgical operation. It is not always indicated and is often left up to the judgment and discretion of the dental officer.

Exercises (486):

1. Identify the procedures performed in the oral surgery section by matching the procedure description in column B to the appropriate procedure name in column A.

Column A

______(1) Biopsy.
______(2) Cystectomy.
______(3) Surgical removal.
______(4) Extraction.
______(5) Frenotomy.
______(6) Tori removal.
______(7) Foreign body removal.
______(8) Alveolectomy.

Column B

a. The surgical removal of the tissue that restricts the tongue's movement.
b. Tooth removal that entails tissue incision, excision, or bone removal.
c. The removal of the sharp bony edges that result from a multiple extraction.
d. The removal of abnormal, bony growths from the body of the mandible or the maxilla.

Column A

Column B

e. The removal of a piece of tissue for diagnostic and miscroscopic examination.
f. The removal of such items as a needle, piece of an instrument, or buckshot.
g. The removal of erupted, diseased, or malposed teeth.
h. The removal of cysts and periapical granulomas.

487. State your duties and the procedures you are to follow as an oral surgery assistant.

Oral Surgery Assisting Duties. Since oral surgery patients tend to be more nervous and apprehensive than other dental patients, it is important that you be a calming influence. You can help a patient relax by performing your duties in a deliberate, calm, and self-confidence manner. The key to self-confidence is preparation. When you become thoroughly familiar with each aspect of your job, self-confidence follows. The accomplished oral surgery assistant is a stabilizing influence to even the most nervous of oral surgery patients.

Preoperative procedures. While the actual procedures for chairside assisting during oral surgery cannot be outlined in any step-by-step sequence, there are several things you can do during the preoperative phase to enhance treatment results.

If possible, you should have previously discussed with the oral surgeon the essentials for each type of oral surgery operation. With such preparation, you can be sure to have the necessary instruments, equipment, and materials ready for each patient. Also, asepsis and strict cleanliness are essential for all surgical operations. Since it is not possible to sterilize the oral cavity, you must take steps to avoid the introduction of foreign bacteria (cross contamination), either through the use of unsterile instruments or materials or by being careless in the preparation of your hands.

Patients awaiting oral surgical treatment normally remain in the main patient waiting room. However, in some facilities a small seating area is located just outside the surgery section. If your clinic has one of these areas, make sure that patients awaiting treatment cannot see into the treatment room. This will help keep them from becoming apprehensive.

Occasionally, a patient will be given a sedation drug before the scheduled appointment time. When this happens, have the patient wait either in the clinic recovery room or in a quiet area of the clinic. Be absolutely sure that presedated patients are not left alone and that a family member or friend has accompanied them and will stay until the treatment is finished. Prior to actually seating the patient in the chair, check to make sure that you left no traces of the previous operation. After you have seated the patient and made him or her comfortable, have the patient loosen restricting clothing and make sure that removable prosthetic appliances are taken from his or her mouth and stored in an appropriate receptacle.

You may be required to perform a full surgical scrub prior to each operation. In any case, the very minimum should be a scrubbing with a handbrush and soap. Mere hand-to-hand lathering and rinsing is simply not enough to satisfy the requirements of oral surgery. After you have completed your scrub, dry your hands on one of the sterile towels that you placed on top of the instrument setup. When you have dried your hands, don the sterile rubber gloves that you will be wearing during the surgical procedure. All of this is done in view of the patient because it helps to reassure him or her. With gloved hands, you may then drape the patient with a sterile drape. Be sure to exercise care that you don't touch any unsterile object during the draping procedure. After these preoperative procedures have been completed, the operation may begin.

Surgical operative procedures. The variations in dental officers' techniques make it very difficult to outline a uniform procedure to be followed for each surgical operation. However, the following procedures can be followed until you know the desires of the dental officer.

First, the majority of oral surgery procedures require two or more injections of local anesthetic. For this reason, it is a good practice to include two aspirating syringes with each instrument setup. This will let you supply the surgeon with a loaded anesthetic syringe for as long as needed with minimum loss of time. Since anesthetic solutions are bitter and there is a leakage from injection sites, you will need to aspirate the fluids from the patient's mouth after injection.

To become an effective oral surgery assistant, you must learn to anticipate the needs and desires of the surgeon. You won't develop this skill overnight; but as you work with a surgeon and learn his or her sequence of performing an operation, you will find that you and the surgeon become a smooth operating team. In assisting the surgeon, plan ahead and see that the next instrument is available when it is needed. When passing instruments to the surgeon, place them firmly in the surgeon's hand, because gloves reduce tactile feeling, thereby increasing the possibility of the surgeon dropping the instrument. This also saves time since the surgeon doesn't have to reach for the desired instrument. Also, this procedure contributes to the smoothness and efficiency of the operation.

During surgical procedures, one of the primary duties is aspirating fluids from the mouth. The hemorrhage produced by surgical procedures, together with the saliva, presents a twofold problem. First, the use of surgical knives, chisels, and rotating instruments makes it imperative that the oral surgeon be able to see what he or she is doing. Secondly, the accumulation of this blood and saliva in the rear of the patient's mouth tends to excite the patient's gag reflex. For these reasons, the need for constant, comprehensive aspirating cannot be overemphasized. You must aspirate in all areas of the mouth, not just in and around the operative site. By anticipating the oral surgeon's moves, you can aspirate ahead of the surgeons. This keeps you from getting in the surgeon's way.

For irrigation, keep a container of sterile, distilled water or saline solution and an irrigating syringe on the instrument tray. Periodically flush the operative site to remove blood, saliva, and debris. A Luer-Lok syringe with a curved, blunted needle is very helpful when flushing a tooth socket, particularly when attempting to remove a broken or retained root tip. You also can use the irrigating solution to dampen gauze sponges for moistening the patient's lips throughout the surgical procedure, to clean blood and debris from instruments prior to returning them to the instrument tray, and to clean the patient's tongue and lips at the operation's conclusion.

Another of your important duties is the careful use of a retractor. There are, of course, many instruments designed as retractors. The mouth mirror also makes an excellent retractor. Make sure that you have a firm hold on retracted tissue, particularly during procedures such as cutting, drilling, or suturing.

You must stay constantly aware of the patient's physical condition during the entire surgical procedure. If any changes occur, quietly point them out to the oral surgeon at once. Always be prepared to lend immediate assistance during an emergency. Under no circumstances should you make a remark on a sudden complication in the procedure. Such remarks tend to excite and further arouse the patient's nervousness. As you might suspect, this could lead to even further adverse patient reaction.

Postoperative procedures. Once the surgical operation is done, moisten a 2- by 2-inch or 4- by 4-inch sponge and use it to remove all blood from the patient's face. It is also a good idea to remove either the blood-stained instruments and aspirator bottle or to cover them with a towel so that they are not visible to the patient. You may then remove the drape and reposition the chair so that the patient is able to exit easily.

Most oral surgeons have instruction sheets for home care of the mouth following oral surgery. Each patient should receive one of these, along with any medication and gauze recommended by the dentist. When the surgeon has finished with the patient, make sure that any future appointments are made and dismiss the patient as cordially as you received him or her. Closely observe the patient as he or she is leaving to make sure that the patient is steady and shows no signs of distress. If the patient exhibits any signs of dizziness, detain him or her until the oral surgeon can evaluate the patient's condition. Make sure you tell the patient's escort of any postoperative instructions.

Exercises (487):

1. Why is it important that you perform each oral surgery task in a deliberate, calm, and self-confident manner?

2. Considering that it is impossible to sterilize the oral cavity, why is it important to maintain asepsis and strict cleanliness for each oral surgery patient?

3. How can you make sure that you are preparing all of the necessary instruments, equipment, and materials needed for each oral surgery patient?

4. If your clinic has a separate oral surgery seating area, what view should be obstructed from waiting patients?

5. What should be done with presedated patients prior to seating them in the treatment room?

6. What should you do immediately after seating an oral surgery patient?

7. What is the very minimum of acceptable hand cleaning procedures you should perform in preparing for oral surgery?

8. Should you drape the patient before or after you don your rubber gloves?

9. Why should you include two aspirating-type anesthetic syringes in each oral surgery setup?

10. When passing instruments to the oral surgeon, why must you place them more firmly in his or her hand when passing restorative instruments?

11. Why is it important to perform constant, comprehensive aspiration during the surgical procedure?

12. What instruments and materials are needed for surgical irrigation?

13. What may be used to moisten the patient's lips during the surgical procedure?

14. What should you do if you notice a change in the patient's physical condition during the oral surgery procedure?

15. After the oral surgery procedure is complete, what should you do prior to removing the patient's drape?

16. Why should you closely observe the patient when he or she is leaving?

6-4. Endodontic Section

The endodontic section treats diseases of the dental pulp. Few dental clinics have a dental officer assigned exclusively to endodontics. Usually, one of the operative dentists spends part of his or her time seeing patients who require root canal therapy. In our discussion of the endodontic section we describe the endodontic procedures that may be performed as well as the basic assisting duties.

488. Specify endodontic procedures, materials, and instruments, and state basic assisting duties and procedures.

There are two specific types of endodontic operations—conservative root canal therapy and the apicoectomy. Let's take a close look at each of these and see what they entail.

Conservative Root Canal Therapy. Conservative root canal therapy is normally effective when the disease of the pulp is fairly well confined to the pulp canal. Usually this treatment is required as a result of a periapical abscess. There are two types of conservation root canal therapy: pulpotomy and pulpectomy. A *pulpotomy* is a procedure in which part, but not all, of the pulp is removed. It is most commonly done on primary rather than permanent teeth. While it is occasionally done on permanent teeth, the success rate is lower than that for primary teeth. A *pulpectomy* and the follow-on enlargement and filling of the canal is the most common procedure done in endodontics. A pulpectomy is the removal of the entire pulp, leaving behind the empty canal. In some cases of conservative root canal therapy, there is no need for anesthesia because the pulp tissues are dead. The objectives of this therapy are to remove the contents of the pulp canal, clear up the infection, and insert a root canal filling material.

Normally, conservative root canal therapy takes one or two appointments, because the infection must be completely cleared up before the canal can be filled. Filling the canal while infective organisms are still present will result in a reoccurrence of the abscess. If the patient is suffering from an acute periapical abscess, he or she will be experiencing severe pain. The pain is due to pressure created by the formation of pus and gases in the pulp canal. The pressure, and therefore the pain, is relieved during the first step of the endodontic procedure. This step is to gain entrance into the pulp canal by drilling directly into the pulp chamber. Once entrance has been accomplished, reamers or files are used to remove dead pulp tissues from the canal.

During subsequent appointments root canal reamers and files are used to enlarge, shape, and smooth the pulp canal. During all appointments a rubber dam is used to isolate the tooth and to prevent contamination of the root canal. Cotton pellits saturated with an antiseptic are introduced into the pulp chamber to help clear up the infection. Radiographs are taken to insure the proper reaming and filing of the canal. Cultures may be taken to assure that growth of micro-organisms within the canal has ceased. If the results of the culture are negative, then the canal is filled with gutta-percha, the most commonly used material, or a silver point, used by few dentists, and sealed permanently with root canal cement. Followup appointments are usually scheduled periodically for X-rays of the restored tooth.

As in all efficient assisting, you should try to anticipate the dental officer's needs. Your function, in the endodontic section, consists mainly of aiding in the placement of the rubber dam, using an irrigating syringe to flush the area, taking cultures, mixing materials, and passing instruments and materials. You should know the exact approach your dentist takes toward root canal therapy in order to effectively anticipate his or her needs.

Apicoectomy. An *apicoectomy* is the surgical removal of the apex of a tooth. It is sometimes indicated when there is possible cystic involvement. In conjunction with removal of the cystic lesion (cystectomy), the apex of the tooth may also be removed; this is termed an apicoectomy. The apicoectomy requires teamwork between the dentist and you. Apicoectomies are usually done in the surgery section, and you must, of course, follow the surgical assisting procedures. After the patient has been draped and anesthetized, the dentist makes an incision facially near the involved tooth's apex. The dentist then uses a surgical bur or chisel to remove the overlying alveolar bone. Once the root is exposed, the dentist uses the bur to remove its apex. Curettes are then used to remove infectious material from around the root tip. The root tip is then filled and sutures are placed to close the incision. The surgical portion of the apicoectomy is done quickly. The longer the patient is subjected to a surgical procedure, the more likely it is that there will be swelling and discomfort.

Most of the information in this section has been general in nature. Dentists vary a great deal in their techniques. When assigned to assist in endodontics, take time to ask the dentist to brief you on his or her methods. Then make every effort to learn to fulfill these requirements.

Exercises (488):

1. Why isn't there need for anesthesia in most conservative root canal procedures?

2. What are the objectives of conservative root canal therapy?

3. Why are two or more appointments usually required for conservative root canal therapy?

4. Once entrance into the pulp canal is accomplished, what is used to remove the dead pulp tissues?

5. What is used to isolate the tooth and prevent contamination of the root canal?

6. What instruments are needed to enlarge, shape, and smooth the pulp canal?

7. What is used to introduce an antiseptic into the pulp canal?

8. Why are cultures of the root canal taken?

9. When is it safe to fill the root canal?

10. What may be used to fill the root canal?

11. What must you know to be an effective endodontic assistant?

12. What endodontic procedure is sometimes indicated when there is possible cystic involvement?

13. What is done to the apex of the root during an apicoectomy?

14. During an apicoectomy, how is exposure of the root tip achieved?

15. What is used to remove infectious material from around the root tip?

16. What assisting procedures should you follow during the apicoectomy?

6-5. Periodontic Section

The periodontic section treats diseases involving the supportive structures of the teeth. The treatment of periodontal disturbances may encompass both the dental and medical professions. The patient will be referred to the medical facility for diagnosis and treatment if it is determined that the cause of the periodontal disturbance is due to systemic factors. Within the dental clinic, the treatment of a periodontal patient may require treatment by the entire dental team.

The periodontist may treat periodontal disease by relieving conditions such as traumatic malocclusion; by eradicating periodontal pockets; and by assuring that the patient practices proper oral hygiene, as previously discussed. The oral surgeon performs his or her service by removing nonrestorable teeth, by making biopsies, and by removing neoplasms. The prosthodontist exercises his or her role by replacing missing teeth with required appliances. The dentist in the restorative section alleviates periodontal ailments by removing and replacing faulty restorations. The services of the orthodontist may be required to reposition malposed teeth.

489. Stipulate why the eradication of periodontal pockets is important, identify the periodontal procedures, and compare the assistant's role in periodontics to his or her role in other specialities.

Purpose of Periodontal Treatment. As you know, periodontal disease affects the supportive structures of the teeth. The primary purpose of periodontal treatment is to eradicate periodontal pockets. Why is eradication of the pockets so important? There are five reasons:

(1) A pocket is an area of food and bacterial accumulation and infection.

(2) A pocket can create conditions (loss of gingival covering) which may lead to exposure of the root and possible caries.

(3) A pocket can cause degenerative changes in the gingiva, which may increase the susceptibility to acute necrotizing ulcerative gingivitis (NUG).

(4) Pockets can cause degenerative changes in the periodontal ligament, and the inflammation from the pocket walls is a factor responsible for the bone loss in periodontal disease.

(5) These pockets can be a source of discomfort to the patient during mastication.

Periodontal Procedures. Eradication of the periodontal pocket may include scaling and root planing, curettage, gingivectomy, osseous contouring, and equilibration. You know that the dentist—not you—does these operations. Your duty is to assist the dentist by passing the proper instruments, keeping the area clear and clean, and setting up for an anesthetic injection (if used).

Scaling and root planing. Occasionally, a dental officer will use a local anesthesia when doing deep subgingival scaling and root planing. To remove deep deposits of calculus, the dentist must slide an instrument gently along the calculus in the direction of the apex until the termination of the calculus on the root is reached, removing the piece of calculus in its entirety if possible. The dentist then planes the root surface until it is smooth. In root planing, the dentist must remove any softened material until firm tooth substance is reached.

Curettage. Curettage consists of removing the necrotic and degenerated tissue lining the gingival wall of the periodontal pocket. (This procedure reduces the periodontal pocket by removing a barrier, which then allows reattachment of the periodontal ligament to the root surface.) The dentist performs the curettage by using the curette instruments. Local anesthetic is normally needed for this procedure.

Gingivectomy. This term means excision of the gingiva. The procedure is a method of periodontal pocket eradication. In practice, the gingivectomy is normally a two-stage operation, consisting of removal of the diseased gingiva and the scaling and root planing of the root surface. The gingivectomy may be used to treat any of the following conditions: deep suprabony pockets (between tooth crown and alveolar bone crest), periodontal abscesses, gingival enlargement, and gingival defects. This procedure is usually done on one quadrant at a time; however, some dental officers prefer to treat both quadrants on the same side of the mouth at one visit.

Osseous contouring. Osseous contouring is the surgical reshaping of bone to eliminate deformities and create physiologic bone contours. This operation is done when the dental officer believes the bone deformities will interfere with proper oral hygiene and gingival massage. Osseous contouring is most often performed with diamond stones; however, bone files, rongeurs, chisels, and large round burs may be used. When the dental officer uses burs and stones, you usually assist by bathing the proper area in a stream of warm water or isotonic saline to minimize injury to the bone from frictional heat.

Equilibration. An equilibration may be done when malocclusion causes any of a variety of periodontal conditions. This procedure normally requires that study casts be made to determine where the occlusion must be adjusted. An equilibration is the adjusting of the occlusal contact areas between the upper and lower teeth so that each tooth carries its equal share of the occlusal load. Then, the dental officer uses mounted stones to grind and adjust the contact areas between the upper and lower teeth. The dental officer may perform an equilibration in conjunction with other periodontal therapy—or as a separate procedure.

Assistant's Role in Periodontics. Your duties in this section are similar to those of other sections, in particular, oral surgery. Keep in mind that the periodontist has several variations of treatment of periodontal disease. To properly discharge your duties, you have to know which instruments and treatment packs the periodontist desires. You should have all instruments and supplies needed for the particular periodontal treatment set up prior to the arrival of the patient. The method of receiving the patient and adjusting the chair and your duties after dismissal of the patient are the same in the periodontal section as those discussed in the chapter dealing with basic assisting procedures. Also you must irrigate and aspirate the operation area during periodontal surgical procedures. Another important assisting duty is to mix, manipulate, and store surgical dressing materials. Frequently, the periodontic assistant also schedules all appointments for the periodontic section.

Exercises (489):

Some of the facts listed in items 1 through 8 are important reasons why periodontal pockets should be eradicated; some are not. Stipulate those that are important reasons with T (true) and those that are not with a F (false). Explain why any incorrect statements are false.

_____ 1. Periodontal pockets are the primary cause of systemic diseases.

_____ 2. A periodontal pocket is an area of food and bacterial accumulation and infection.

_____ 3. Periodontal pockets result in the loss of nutritional food values and often lead to malnutrition.

_____ 4. Periodontal pockets can be a source of discomfort to the patient during mastication.

_____ 5. Periodontal pockets contain large quantities of harmful and predominantly aerobic bacteria.

_____ 6. Periodontal pockets cause degenerative changes in the gingiva which increase susceptibility to NUG.

_____ 7. Periodontal pockets cause degenerative changes in the periodontal ligament, and the inflammation from the pocket walls is a factor responsible for the bone loss in periodontal disease.

8. In items 1 through 5 identify the periodontic procedures by matching the description in column B to the procedure in column A.

Column A

_____ (1) Gingivectomy.
_____ (2) Scaling and root planning.
_____ (3) Equilibration.
_____ (4) Curettage.
_____ (5) Osseous contouring.

Column B

a. The procedure that consists of removing the necrotic and degenerated tissue lining the gingival wall of the periodontal pocket.
b. This method of pocket eradication is accomplished by the excision of the gingiva.
c. The surgical reshaping of bone to eliminate deformities and create physiologic bone contours.
d. The adjusting of the occlusal contact areas between the upper and lower teeth so that each tooth carries its equal share of the occlusal load.
e. Performed to remove deep deposits of calculus and to smooth the root's surface.

9. To what section are the duties of the periodontal assistant similar?

6-6. Prosthodontic Section

Prosthodontic dentistry deals with the substitution or replacement of oral structures. Prosthodontic dentistry can include anything from replacing one missing tooth to constructing an intricately designed device to replace missing structures in a cleft palate. Most prosthodontic treatments are concerned with replacing missing teeth. You will recall from previous chapters that teeth are lost for many reasons. Older patients may lose some or all of their teeth because of advanced periodontal disease, whereas younger patients are more likely to lose teeth from advanced caries or accidents. The replacement of these missing teeth requires the skill of the prosthodontist. You form part of the "prosthodontic team." In this section your assisting duties are very similar to those of other sections in the dental clinic. The primary differences are the type of treatment being performed, the material that you mix or manipulate, and the instruments that are used.

490. State the examination requirements for each new prosthodontic patient, indicate why radiographs are necessary, and specify the factors that influence scheduling.

Patient Requirements. Each new prosthodontic patient requires a periodontal examination, which may include complete oral radiographs. The dental officer will make diagnostic casts when indicated. He or she uses the radiographs to diagnose cysts, residual roots, unerupted teeth, impacted teeth, periodontal conditions, caries, bone density, or other conditions requiring operative or surgical correction before prosthodontic treatment is started. The diagnostic casts reveal irregularities of the occlusion that must be corrected before beginning prosthodontic treatment. These casts also reveal irregularities that will be a factor in determining the type of appliance to be constructed. In planning prosthodontic treatment, all oral surgery, and periodontic, endodontic, and restorative treatment should be completed before beginning prosthodontic treatment.

Appointment Scheduling. Most prosthodontic cases require a series of appointments. It's usually your duty as the prosthodontist's assistant to schedule these appointments. Two basic factors influence the scheduling of prosthodontic patients. These factors are the procedures to be done during the appointment and the laboratory time required between appointments. These factors will, of course, dictate the time allocation and date for which you should reschedule the patient.

You must understand the procedure being carried out and know the varying amounts of time that must be allowed for laboratory work between visits of a patient. Never hesitate to ask the dental officer and coordinate with the laboratory concerning time allocation for various procedures so that the dental officer's and laboratory technician's time is efficiently utilized.

Exercises (490):

1. What type of examination is required for each new prosthodontic patient?

2. How are full-mouth radiographs used by the prosthodontist?

3. How are diagnostic casts used by the prosthodontist?

4. What are the factors that influence the scheduling of prosthodontic patients?

5. How can you help assure that the dental officer's and laboratory technician's time is efficiently utilized?

491. State the procedures and assisting duties involved with prosthodontic fabrication.

Prosthodontic Procedures and Assisting Duties. Prosthodontic treatment is concerned primarily with replacing missing teeth with some type of artifical substitute. These substitutes for the natural teeth are called prosthodontic appliances. Normally, there are four groups of prosthetic appliances: dentures, crowns, inlays, and special maxillofacial appliances.

The basic clinical steps for prosthodontic procedures are essentially the same in all clinics, but the sequence of steps and the materials required varies with the individual dental officer and the specific requirements of the patient. Because this is true, you must be adaptive and so well prepared that you can give the needed assistance at the proper time and in the desired manner. This is not as difficult as it sounds. If you are familiar with the general prosthodontic procedures and materials, you should have little trouble mastering any variations.

Complete or full dentures. A complete denture is an appliance that replaces the full number of teeth in the arch. It is made from acrylic with procelain or acrylic teeth. This procedure usually requires five appointments.

During the first appointment, the dental officer takes maxillary and mandibular preliminary aliginate impressions, and records information and directions on AF Form 944, Dental Laboratory Prescription and Consultation Request. While there are several suitable impressions, dentist usually use cake compound to make the first impression. To make the impression, the dentist places this softened compound in an impression tray and presses it against the oral tissues. The bottom of the tray is then sprayed with cool water until the compound hardens, after which the impression is withdrawn and sent to the laboratory. The laboratory pours the impression and builds a custom tray.

Your duties during the first appointment may include all or part of the following:

(1) Soften the compound in the compound heater, following the manufacturer's directions.

(2) Place petroleum jelly on the lips and around the mouth of the patient to prevent materials from sticking to the skin.

(3) Chill the compound in the mouth with cold water as the dental officer holds it in place.

(4) Perform routine assisting duties and assist the dental officer as directed.

(5) Initiate AF Forms 994 and 644.

The final impression is made during the second appointment, using the individual impression tray, is made by the laboratory. This tray may be made of acrylic resin, shellac baseplate, or special tray material. The tray is usually border molded before the final impression. The impression material used is usually one of the "wash" types, usually zinc oxide paste or plaster. The final impressions are taken to the laboratory, and the master casts are poured. Occlusion rims are then constructed on a baseplate that the laboratory has adapted to the master casts. Your duties during this second appointment are:

(1) Coat the area around the patient's mouth with petroleum jelly so that the impression material will not stick to the skin.

(2) Mix the impression material. If you use zinc oxide paste, mix it on a parchment pad. If you use plaster-type impression material, mix it in a rubber bowl.

(3) Perform routine duties and assist as directed.

(4) Add applicable information to AF Form 994 and fill out AF Form 644 for the patient's visit.

(5) Take the final impression to the laboratory.

The third appointment is used for interocclusal relationship. The dental officer takes several measurements of the patient, such as centric relation, vertical dimension, and the occlusal plane, this is done by placing the baseplate and occlusal rim (and using a sharp instrument to mark the relationship) on the wax occlusal rim. The baseplates and the occlusal rims are then placed back on the master casts, and the cast goes back to the dental laboratory. Laboratory personnel now mount the casts on an articulator, set up the artificial teeth in the wax occlusal rim, and trim the wax until it resembles a denture. Your duties during the third appointment are:

(1) Aid the dental officer as required in recording interocclusal relationships.

(2) Assist as directed.

(3) Add applicable information to the patient's AF Form 994.

(4) Return the occlusion rims to the laboratory so that the teeth may be set up.

(5) Fill out AF Form 644.

The purpose of the fourth appointment is to try the waxed-up trial dentures in the patient's mouth. This is done to check appearance, functional relationship, and other measurements. To prevent warpage, the laboratory sends the trial dentures to the dental treatment room on the master casts. Since the teeth are set up in wax for the try-in, the dentist may move them about, if necessary, for both esthetics and function. Your duties during the fourth appointment are:

(1) Get the trial dentures from the laboratory.

(2) Assist as directed.

(3) Add applicable information on the patient's AF Form 994.

(4) Fill out AF Form 644.

(5) Return the trial dentures to the laboratory so that the dentures may be processed and finished.

The fifth appointment is the final one in the production of complete dentures. This appointment is used by the dental officer to insert the completed denture in the mouth and make final corrections. The dental officer also instructs the patient on the proper care and wearing of the dentures. Your duties for the final appointment are:

(1) Get the completed dentures from the laboratory.

(2) Assist as directed.

(3) Make proper entries on AF Form 994; AF Form 644; and SF 603, Health Record—Dental.

Exercises (491):

1. What is the function of a full denture? What is it made of?

2. What happens during the first full denture appointment?

3. What are your duties concerning the compound impression material used during the first appointment?

4. Why should you place petroleum jelly on the lips and around the mouth of the patient?

5. What is the purpose of the second appointment for full denture fabrication?

6. What type of impression is usually used for the final full denture impression?

7. What do dental laboratory personnel do between the second and third appointment for full denture fabrication?

8. What is the purpose of the third appointment for full denture fabrication?

9. What does the dental laboratory do between the third and fourth full denture appointments?

10. What is the purpose of the fourth appointment for full denture fabrication?

11. What is the purpose of the fifth appointment for full denture construction?

492. State the procedures and assisting duties with removal partial denture fabrication.

Removable partial dentures. A removable partial denture replaces less than the full number of teeth in one arch. It is made from gold, chrome-cobalt, or acrylic, with procelain or acrylic teeth. A thorough examination, which may include a full set of radiographs, is done before the partial denture is started. The impressions for study casts are made at this time. This preliminary examination is made for the same reasons as the preliminary examination for a full denture. Another reason is to decide where the rest preparations must be prepared in the teeth. A rest preparation is a cut on the surface of a tooth made by the dental officer to accommodate the occlusal or incisal rest of a removable partial denture.

There are usually three appointments involved with this procedure. The first appointment prepare rest preparations in the teeth to be used as abutments (a tooth upon which the clasp is placed to retain, support, or stabilize a removable partial denture). It is also used to take impressions of the hard and soft structures of both arches of the mouth. After the dental officer prepares rest seats on the abutment teeth, the patient's teeth may need to be cleaned and polished (all debris removed) before the impressions are taken. One of the elastic impression materials (usually alginate hydrocolloid) is used for the impression. The material is placed in a rimlock, perforated, or individual impression tray. After the dental officer withdraws the impressions from the patient's mouth, they should be taken to the laboratory to be poured up as soon as possible to prevent distortions caused when the impression material dries out. A stone (hydrocal) mix is used to pour the impression. The master casts are sent to an area dental laboratory (ADL) to have the metal framework constructed. Your duties include the following:

(1) Clean and polish the patient's teeth (when required).
(2) Mix and prepare the impression material according to the manufacturer's instructions and place it in the impression tray.
(3) Assist as directed by the dental officer.
(4) Prepare AF Forms 994 and 644.
(5) Take the impressions to the laboratory.

The second appointment is used to establish and record the relationship between the maxillary and mandibular arches. The dental officer establishes the centric relationship with the occlusion rim(s) placed in the patient's mouth. In some cases, the metal framework of the partial denture will be used to build occlusion rim(s). The tooth shade and mold will also be obtained at this time. Your duties during the second appointment are:

(1) Obtain the occlusion rims from the laboratory.
(2) Assist as directed.
(3) Make proper entries on AF Forms 994 and 644.
(4) Return the case to the laboratory for the final fabrication.

The purpose of the third appointment is to insert the completed removable partial denture. The dental officer inserts the completed denture in the mouth and makes necessary adjustments, such as clasps. The dental officer will also instruct the patient on proper care and wearing of the dentures. Your duties during the insertion appointment include:

(1) Assist the dental officer as directed.
(2) Return the denture to the laboratory for polishing after alterations have been made.
(3) Make proper entries on AF Form 994 and SF 603.

Exercises (492):

1. What is the function of a removable partial denture? What is it made of?

2. What happens during the first appointment for removable partial denture fabrication?

3. What type of impression tray should you choose for an alginate impression?

4. Why should the impression go to the laboratory as soon as possible after removal from the patient's mouth?

5. What does the dental laboratory do between the first and second appointments?

6. What happens during the second appointment?

7. What is the purpose of the third appointment?

493. Identify the types of crowns and inlays, state their purpose, and trace the steps required for their fabrication.

Crowns and inlays. Artificial crowns replace all or part of the coronal portions of a tooth and may be made of gold, porcelain, acrylic, or a combination of these materials. There are several types of crowns as described below:

(1) Complete veneer crown. This crown covers the entire coronal portion of an anterior tooth and is made of acrylic or porcelain.

(2) Partial crown. This crown covers four or more, but not all, surfaces of the coronal portion of a tooth, usually the mesial, lingual, and distal.

(3) Veneered metal crown. The veneer crown is a gold crown, the facial surfaces of which are covered with a porcelain or acrylic shell.

(4) Thimble or coping crown. This is a porcelain or acrylic crown or jacket that is placed over a gold casting or platinum shell.

(5) Full gold crown. This is a crown that is made completely of gold. It is used to restore the coronal portion of a tooth.

Inlays are cast restorations that are fabricated, usually in gold, to correspond with the form of a cavity and then cemented into the cavity. They also may be made of porcelain or plastic. Inlays are grouped into five classes, which are numbered I to V according to the surfaces of the tooth restored:

a. Class I. These restorations include the occlusal surface of a bicuspid or molar (and sometimes the facial or lingual surface of other teeth).

b. Class II. These restorations include the occlusal surface combined with either the mesial or distal surface, or both.

c. Class III. These restorations are limited to the mesial or distal surface of an anterior tooth not involving the incisal edge.

d. Class IV. These restorations involve the mesial or distal surface of an anterior tooth involving the incisal edge.

e. Class V. These restorations are confined to the facial or lingual surface.

There are two techniques for making and replacing gold crowns and inlays: direct and indirect. With the direct technique, the dentist prepares the tooth first, and then construct the wax pattern of the crown or inlay in the mouth. With the indirect technique, the dentist takes an impression of the prepared tooth in a copper band or crown and bridge tray filled with a suitable impression material, such as rubber base. If the direct method is used, the wax pattern is used by the laboratory for investing and casting. If an impression is taken, the impression is poured to make a die (positive reproduction), and a wax pattern is made on the die. Next, this pattern is placed on a sprue, put in a casting ring, and imbedded in an investment (heat-resistant gypsum) material (fig. 6-1). This process is called investing. When the investment material hardens, the sprue is removed. The casting ring is placed in an oven and the wax is then burned out to form a mold. The casting ring is then placed in the casting machine and molten metal is cast into the mold to form the crown or inlay. A temporary restoration or crown is placed on the tooth to protect it until the permanent restoration is completed. Your duties during the first appointment are:

(1) Cool the tooth with water during the cavity or tooth preparation or manipulate the suction apparatus to keep a clear field.

(2) Mix impression materials.

(3) Help prepare temporary restorations or crowns.

(4) Take the impressions or wax pattern to the laboratory.

(5) Complete appropriate administrative work.

The second appointment is used to cement or seat the crown or inlay onto the tooth preparation. The dentist tries the crown or inlay in the patient's mouth. After making any necessary alterations, the dentist cements the crown or inlay into place. The dentist will use the crown and bridge cement that he or she prefers. Your duties during the insertion appointment include the following:

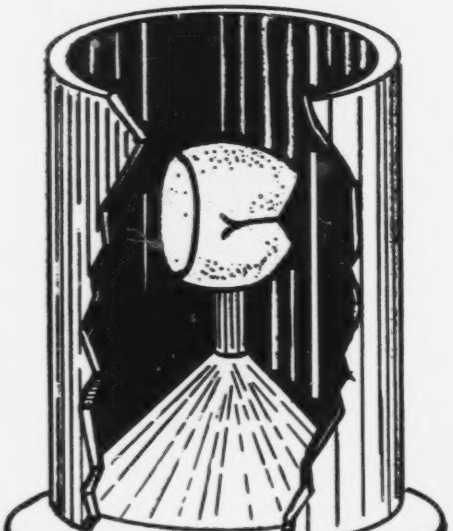


Figure 6-1. Investing.

(1) Mix the cement.
(2) Assist as directed.
(3) Complete appropriate administrative work.

Exercises (493):

1. Identify the types of crowns and inlays by matching the description in column B to the type of restoration in column A.

Column A

_____ (1) Class V inlay.
_____ (2) Partial crown.
_____ (3) Class II inlay.
_____ (4) Thimble or coping crown.
_____ (5) Class IV inlay.
_____ (6) Full gold crown.
_____ (7) Complete veneer crown.
_____ (8) Class I inlay.
_____ (9) Class III inlay.
_____ (10) Veneered metal crown.

Column B

a. A cast restoration that includes the occlusal surface combined with either the mesial or distal surface, or both.
b. A gold crown, the facial surface of which has been covered with a porcelain or acrylic shell.
c. A cast restoration that is confined to the facial or lingual surface.
d. An acrylic or procelain crown that covers the entire coronal portion of an anterior tooth.
e. A cast restoration that is limited to the mesial or distal surface of an anterior tooth not involving the incisal edge.
f. A porcelain or acrylic crown that is placed over a gold casting or platinum shell.
g. A crown that covers three or more, but not all surfaces of the tooth's coronal portion.
h. A cast restoration that includes the occlusal surface of a bicuspid or molar.
i. Constructed completely of gold and restoring the coronal portion of a tooth.
j. A cast restoration including mesial or distal surface of an anterior tooth involving the incisal edge.

2. Briefly describe the events that occur chairside during the first appointment for a crown or inlay using the direct technique.

3. Briefly describe the events that occur chairside during the first appointment for a crown or inlay using the indirect technique.

4. If an impression is taken, upon what is the wax pattern built?

5. Briefly describe how the wax pattern is converted into a metal crown.

6. What is done during the second crown or inlay appointment?

7. State the purpose of crowns and inlays.

494. State the function of a fixed partial denture, and specify the procedures and materials involved in its fabrication.

Fixed partial dentures (bridge). A fixed partial denture is an appliance permanently fixed to abutments (a tooth that supports a fixed partial denture) with inlays or crowns which cannot be removed by the patient. It is usually made from gold and may have procelain or acrylic facings. The missing teeth are replaced by pontics. A pontic is a gold artificial tooth suspended from one or more abutments of a fixed partial denture. Veneered acrylic or porcelain facing may be attached to the pontic for esthetics. A fixed partial denture that has an abutment only on one side is called a cantilever bridge.

The fabrication and insertion of a fixed partial denture are carried out in sequential steps. The dental officer prepares the abutment teeth in a similar fashion as for crown or inlays, and takes the necessary impressions. Dies are made from the impression. Either the dental officer or a dental laboratory technician will make a wax pattern on the dies. The technician then invests, burns out, and casts the wax patterns. The inlays or crowns are placed on the teeth, and an impression is taken of the entire arch with the castings in place. The impression is poured up with a special soldering investment. The pontic is then stabilized in its proper position with soldering investment. The pontic is then attached to the castings with gold solder, and the castings with the attached pontic are finished, polished, and cemented into place in the mouth. This procedure is usually done in three appointments. Your duties are similar to those of other procedures previously discussed in this chapter.

Exercises (494):

1. Briefly describe a fixed partial denture.

2. What is a pontic?

3. What is a fixed partial denture called that only has an abutment on one side?

4. What procedures are followed to properly position and attach the pontic to the abutment castings?

495. Given a series of statements concerning special maxillofacial appliances, indicate which are true and which are false.

Special maxillofacial appliances. There are other prosthodontic appliances that you should be aware than those we've discussed. Because these appliances are not often seen in USAF dental clinics, we will discuss them only in general terms.

Bite-raisers. Bite-raisers are appliances that increase the vertical dimension of the occlusion. This type of prosthodontic appliance is generally used on patients who have gradually lost vertical dimension from wear, loss of teeth, or temporomandibular joint problems. Because of the difficulties involved in establishing a balanced occlusion with this type of appliance, it is a common practice to first make a temporary removable appliance of acrylic resin. After the patient has worn the temporary appliance long enough to determine its effectiveness, a permanent appliance is made of metal.

Obturators. Obturators are appliances that close the unnatural opening between the mouth and nasal cavity of a patient with a cleft (partially split or divided) palate. Ideally, the obturator should fully restore the functions of the tissue it replaces. The palatal portion of the prosthesis should also restore the resonance necessary for distinct speech.

Splints. Splints may be used to either provide anchorage for pressure applied in reducing a fracture or to hold the bone in proper alignment after it has been reduced by other means. In addition to their use in treating factures, splints are sometimes used during periodontal treatment to temporarily stabilize mobile teeth during the healing process. Normally, impressions of both arches are made so that when the splint is made and not interfere with normal occlusion.

Exercises (495):

Indicate whether the following statements concerning maxillofacial appliances are true (T) or false (F). Explain any false answers.

_____ 1. Appliances used to close unnatural openings between the mouth and the nasal cavity are called bite-raisers.

_____ 2. An obturator should restore the resonance necessary for distinct speech.

_____ 3. When preparing a fracture splint it is only necessary to take an impression of the arch being splinted.

_____ 4. The function of a bite-raiser is to increase the vertical dimension of occlusion.

_____ 5. In addition to their use in treating fracture, splints may also be used to stabilize mobile teeth during periodontal treatment.

_____ 6. Bite-raisers are always constructed from a dental metal.

496. Name the types of denture repairs, and state the purpose and the procedure for relining or rebasing dentures.

Repairing, Relining, and Rebasing Dentures. In addition to fabricating new prosthodontic appliances, the dental clinic must also service existing appliances. As with the original fabrication, the bulk of the work usually is done in the dental laboratory. We begin our discussion of these procedures with repairing dentures.

Repairing. You will see many types of broken dentures in a USAF dental clinic. In most cases, the repair is possible. The dental laboratory is able to replace fractured or missing artificial teeth, to mend fractures of the acrylic denture base material, and, in some cases, able to restore damaged frameworks to their original condition. From the clinical viewpoint, you may think of the needed repairs as being of two types: (1) repairs that can be made in the laboratory without an impression or (2) repairs that require an impression. Impressions are not usually needed if an anterior or posterior tooth is to be replaced or if the pieces of the fractured denture base material fit firmly and unmistakable into their original position. If denture base material is fractured to the extent that it is difficult to establish the exact original relationship of the material, an impression of that single arch usually is taken. An impression permits repair to be made on an accurate cast of the patient's mouth. The dental officer will tell you the type of impression material and tray to use for each case.

Relining and rebasing. Mouth tissues that support dentures undergo a certain amount of shrinkage over a period of time. This change may be seen as a loss of vertical dimension, a deviation from centric occlusion, or a loosening of the denture. To correct these conditions, the dental officer may reline or rebase the denture.

A *reline* is done when the denture becomes loose in the mouth and the dental officer decides that the difficulty can be remedied with a new lining or refitting. To do this, the dentist makes an impression inside the denture. That is, the denture serves as an impression tray. The laboratory then substitutes new acrylic for the impression material, and the relined denture is inserted in the patient's mouth. The occlusion is usually adjusted at this time.

Rebasing consists of replacing the entire denture base with new material. This procedure is similar to the reline procedure. The actual fabrication is done in the laboratory. When it is returned to the clinic for insertion, it is handled much the same as a new denture.

Exercises (496):

1. From a clinical viewpoint, what are the two types of denture repairs?

2. What causes the need for relining or rebasing dentures?

3. What is used as the impression tray for relines or rebases?

4. Where are the actual relining or rebasing procedures done?

497. Name the methods and specify the materials and procedures involved in pouring and trimming casts.

Pouring and Trimming Casts. While dental laboratory specialists usually do the pouring and trimming of casts, there will be times when you will have to handle these tasks. For example, if you take an impression to the laboratory and all the laboratory personnel are busy, you'll need to go ahead and pour the casts. If you wait for a technician, dehydration or temperature variations will probably distort the impression. You also may have to trim casts from time to time if your dental officer asks you to.

Pouring casts. To produce a good cast, you need to use a properly mixed gypsum product. Most often you'll use a mix of plaster of Paris, hydrocal (dental stone), or minor variations of these. To assure a good cast mix, do the following:

a. Always use a clean mixing bowl and spatula.

b. Always add the powder to the water, never the water to the powder.

c. Spatulate thoroughly, incorporating all of the powder evenly throughout the mix.

d. Avoid whipping the mix, which will cause the final product to have excessive air bubbles.

e. Help eliminate air bubbles from the mix by occasionally jarring the bowl against the bench top, by holding the bowl on the vibrator for a few moments, and by subjecting the final mix to a vacuum, mixer-investor machine (used to mix gypsum products and to eliminate air bubbles).

f. Never add water to a mix that is too thick; this interferes with the setting mechanism.

g. Whenever possible, use mechanical spatulation.

When you have the desired mix, you are ready to pour a cast, using one of three methods: boxed, upright, or two-step.

While the boxed method is generally the best method for inexperienced people, it is very difficult to use when pouring agar or alginate impressions because of the beading (bordering the outermost limits of the impression with utility wax) requirement. The utility wax does not adhere very well to agar and alginate materials. Impressions made with impression compound and custom acrylic trays are comparatively easy to bead and box for pouring.

For an illustration of the boxed method, see figure 6-2. Part A shows a typical maxillary edentulous impression. Part B shows the impression after beading with utility wax. With this method, apply beading at about 3 millimeters below the height of the peripheral (outward boundary) roll and extend it across the posterior border. Part C shows the impression after the beading and boxing wax has been applied. The boxing is now complete and the impression is ready to pour. Part D shows the boxed impression being poured with dental stone. Note the vibrator. It helps

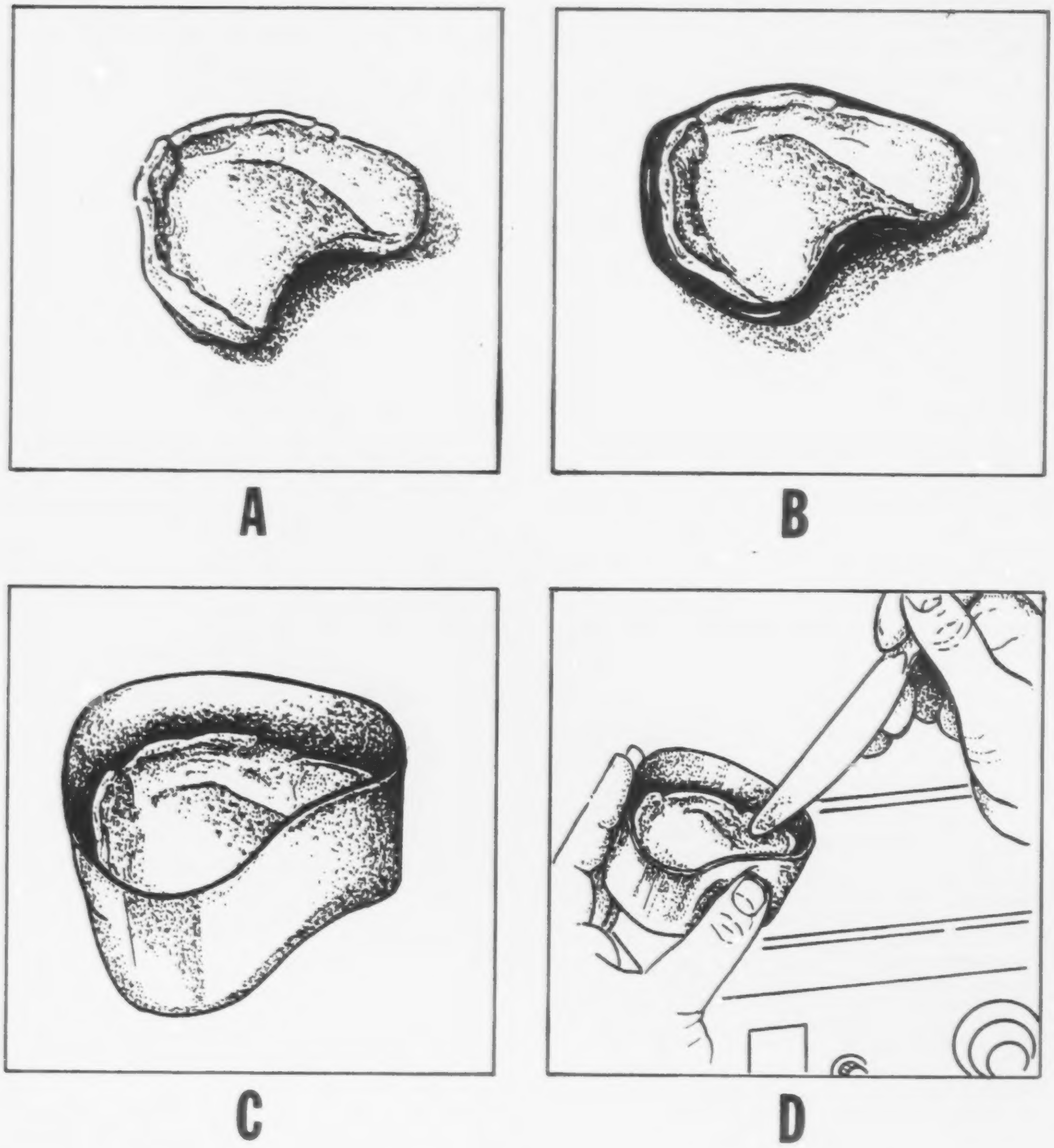


Figure 6–2. Box method for casts.

eliminate air bubbles and aids in making the stone flow to fill in voids and low spots.

The boxed method is the best method for insuring that all peripheral borders are complete.

The upright method of pouring impressions is commonly used by experienced laboratory personnel, because it saves time and produces an accurate cast. Beginners, however, have a hard time with this method controlling the thickness and shape of the final cast. As the method name implies, the impression must remain in an upright position throughout the pouring and remain in this position until the plaster or stone hardens.

Figure 6-3 shows the usual steps in pouring an edentulous mandibular impression. Part A shows a dental stone being vibrated into the tooth areas of the mold. Part B shows dental stone being vibrated into the area that forms the floor of the mouth. Notice that a tongue spacer has been placed in the inner horseshoe area of the impression tray. Wet paper, asbestos, wax or any other suitable material may be used to construct the tongue spacer. Part C shows that stone has been added to build the model to the desired thickness. The base is also flattened and smoothed.

The final method of pouring impressions is the two-step method. It requires two mixes of either hydrocal or plaster of Paris.

Figure 6-4, parts A, B, C, and D, illustrates the two-step method. Part A shows the impression being poured with dental stone to a level slightly above the height of the impression walls. Note also that the surface of the stone is left rough. Part B shows that the second mix of dental stone has been formed into a patty. Part C shows that the impression containing the hardening initial mix is inverted onto the patty formed by the second mix. The soft second mix is then shaped to form the base of the model, as shown in part D.

Trimming casts. Except for the casts you produce by the boxed method of pouring, you'll need to trim the rough and excess portions of the cast base. Of course, even some of your boxed impression casts will need trimming and smoothing because the base is too thick or the surfaces are irregular. You may be thinking that minor irregular surfaces or a cast base that is only slightly too thick should cause little or no concern. Basically this is true, but since the dental profession's motto is "always put our best foot ward," we should always be "neat conscious" about everything the patient might see in the dental treatment room. Thus, dental casts should present a neat, attractive appearance.

In most cases, you trim dental casts on a machine called a model trimmer. This electrically operated machine has a 10-inch abrasive wheel, a small worktable, and a water-dispensing mechanism to keep the abrasive wheel rinsed clean. The worktable is located near the access opening to the abrasive wheel, and is usually adjustable so that you can trim a model at nearly any angle.

Before trimming a cast, it's a good idea to mark it with trimming lines. These lines will help you determine the base thickness; to align the base plane to the occlusal plane of the teeth; and to trim the outer boundary alongside the posterior teeth, the anterior teeth, and the posterior border of the cast. If the occlusal plane of the teeth is not parallel with the plane of the cast base, trim the base until it is parallel. Normally, the base should be from 3/8 to 1/2 inch thick. Trim the outer boundary alongside the teeth to the outermost edge of the peripheral (vestibular mucosa) roll. There are two general ways of trimming alongside the periphery. One way is to follow the contour completely around the peripheral boundary. The other way is to trim the outer peripheral boundary in four straight lines. These lines generally run from the third molar area to the cuspid on either side of the model and forms the cuspid to the midline on either side of the cast. Trim the posterior border so that the highest point does not exceed the occlusal plane level. See figure 6-5 for examples of casts trimmed in these two ways.

Exercises (497):

1. Why must impressions be poured as soon as possible?

2. What gypsum products are used to pour impressions?

In items 3 through 8, identify the true statements concerning the mixing of gypsum products with a T and the false statements with an F. Explain any false answers.

_____3. Whenever possible, use mechanical spatulation in preference to hand mixing.

_____4. Use a clean bowl and mixing spatula.

_____5. Whip the mix to insure the complete incorporation of all powder particles.

_____6. Always add the water to the powder.

_____7. Help eliminate air bubbles from the mix by jarring the bowl against the bench top or by holding it on the vibrator.

_____8. If the mix appears too thick, you should add a little water.

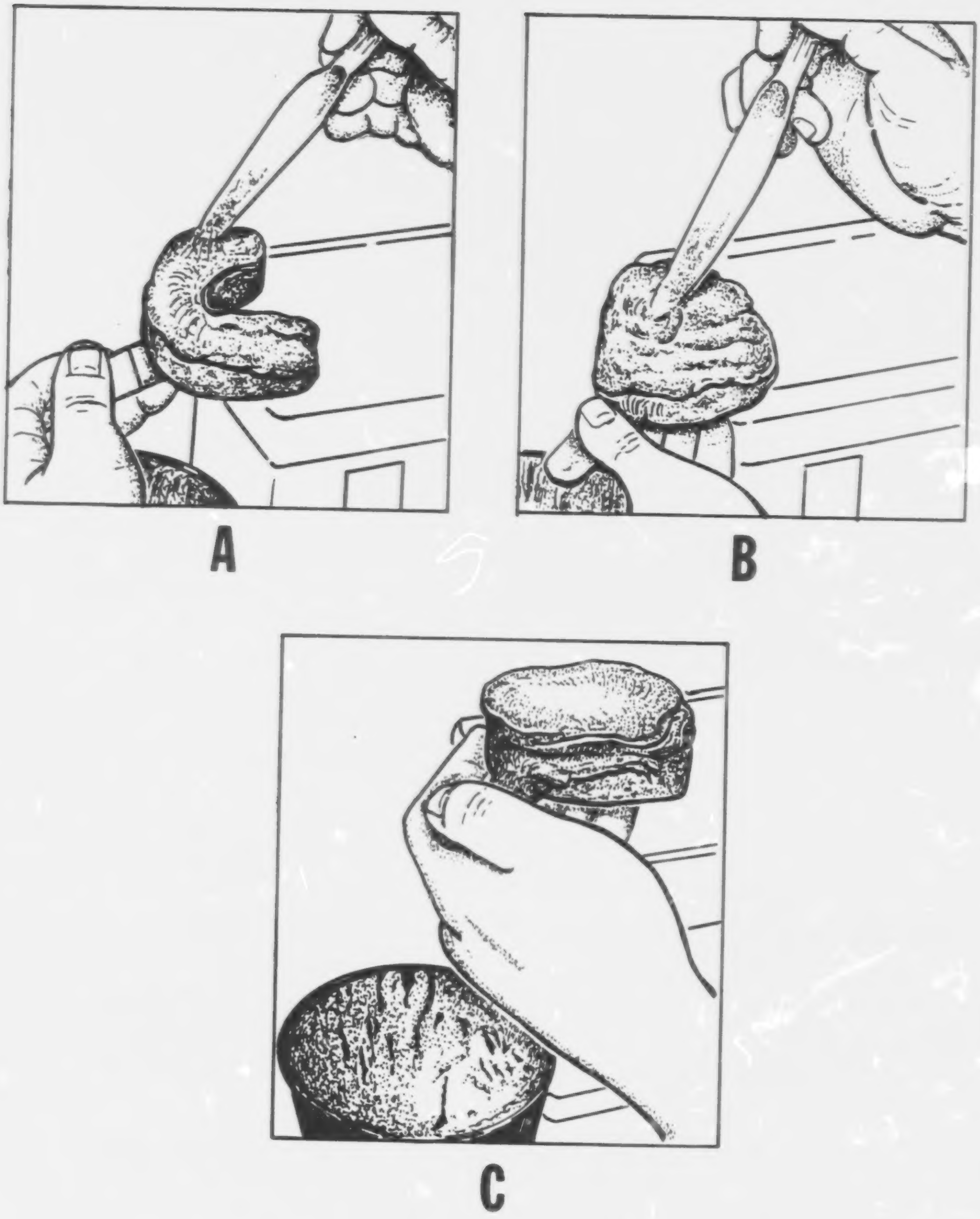


Figure 6–3. Pouring up edentulous mandibular impression.

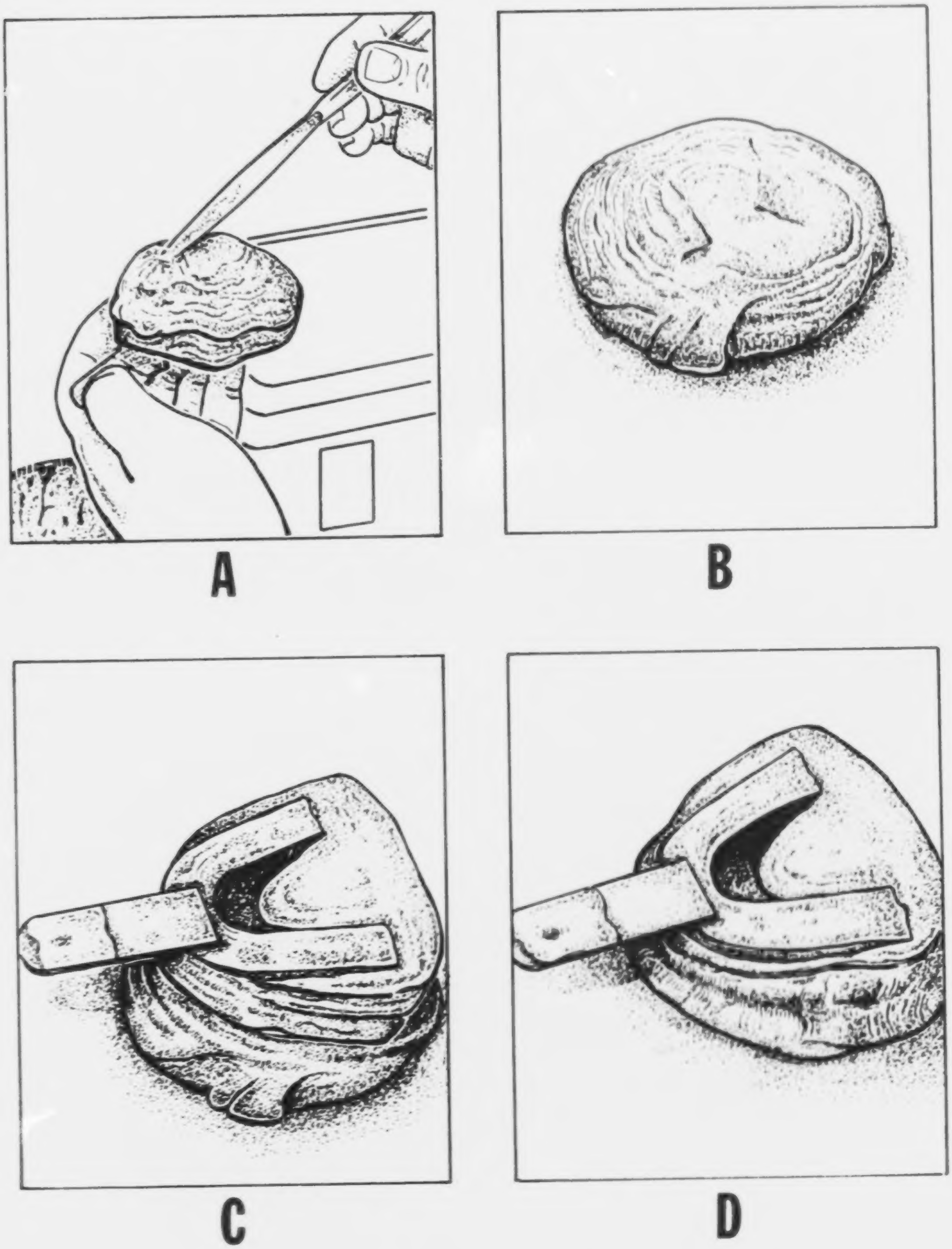


Figure 6–4. Two-step method for pouring impressions.

9. Name the method of pouring impressions in which you invert the impression containing the hardened initial mix onto the patty formed by the second mix.

10. Name the method of pouring impressions in which you employ dental waxes to form a matrix for the gypsum product.

11. Name the method of pouring impressions in which the impression remains in the upright position throughout the pouring and in which the stone is added, smoothed, and flattened to build the model to the desired thickness.

12. What materials may be used to construct a tongue spacer when pouring mandibular impressions?

13. When pouring impressions, what equipment is used to help eliminate air bubbles and to aid in making the stone flow to fill voids and low spots?

14. Name the equipment that is usually used to trim casts.

15. Normally, how thick should the base of the trimmed cast be?

16. How close to the teeth should the outer boundary of the cast be trimmed?

17. Briefly describe the two methods of trimming alongside the periphery.

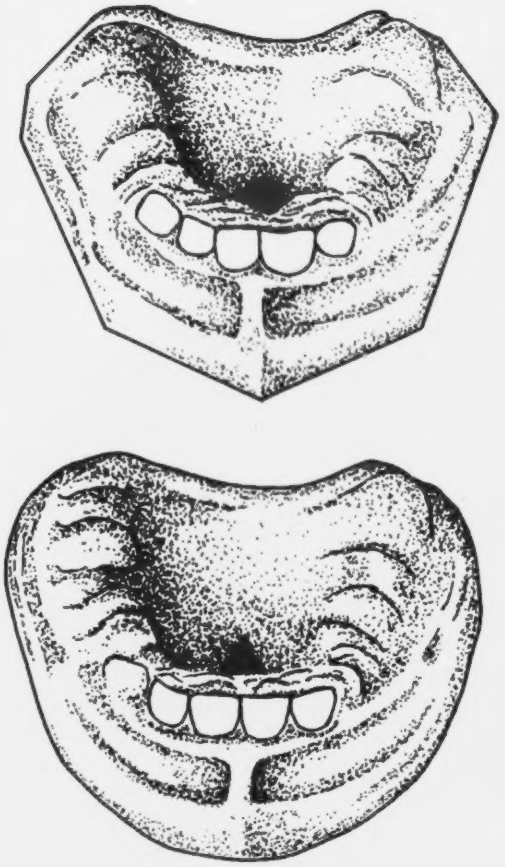


Figure 6-5. Trimming casts.

498. State the methods and procedures involved in the tray construction.

Fabricating Custom Impression Trays. Most dental officers prefer to have custom impression trays made for use in taking final (detailed) impressions. These trays may be made from baseplates (thick shellac sheets), impression compound, or acrylic. Probably the most common type of material used for making impressions is the self-curing resin (acrylic). See figure 6-6 for a typical acrylic impression tray.

There are generally two ways to make acrylic impression trays—the dough and the sprinkle methods. Before adapting the tray material, you must coat the cast with a suitable separating medium, such as tinfoil or alginate solution (sodium or potassium alginate in distilled water). When using the dough method, you mix the acrylic (powder and liquid) until the mix reaches the dough stage and then mold it with your hands into a fairly thin wafer. You may then adapt the wafer to the cast. Use some of the same material to form a handle on the anterior part of the tray. To use the sprinkle method, you also must have a model coated with a separating medium. The tray making then begins by first sprinkling the acrylic powder (polymer) over the cast and next adding enough liquid to saturate the powder. This procedure is continued until the tray is of uniform and adequate thickness. Usually custom impression trays are made for patients who need prosthetic care.

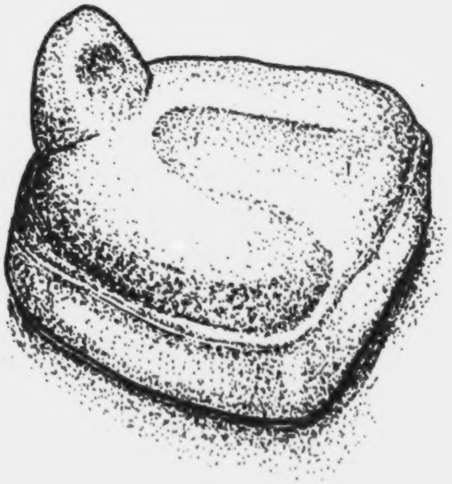


Figure 6–6. Typical acrylic impression tray.

Other factors to consider when making custom impression trays are blocking out cast undercuts, adding spacers, and perforating the trays. If the cast you are to use has deep undercuts, you must remember to block them out before adapting the acrylic. Failure to do so will result in a damaged cast or tray when you attempt to remove the hardened (set) tray. You may block out (fill in) the undercut areas with baseplate wax or modeling clay. Some dental officers prefer to use impression trays which have had spacing provided. By spacing, we mean that you provide a tray that is larger than the cast. To meet this requirement, first adapt a sheet of baseplate wax to the cast before adapting the acrylic. Some dental officers also prefer to have custom trays perforated. Perforations provides escape areas for the impression material, which minimizes tissue displacement, and provides retention of the impression material to the tray. Before making a custom impression tray, it is good policy to ask your dental officer what provisions he or she desires in the tray and make it accordingly.

Exercises (498):

1. How are custom impression trays used?

2. What is the most common material used for custom tray construction?

3. What are the two methods of making acrylic impression trays? Briefly describe each method.

4. Why is it necessary to block out undercuts when building a custom impression tray?

5. How can you block out undercut areas of the cast?

6. If the dental officer prefers to have an impression tray with spacing, how can you provide this spacing?

7. What purpose could be achieved by perforating a custom tray?

499. Define "biting relationships" and state baseplates and bite rims construction procedures.

Baseplates and Bite Rims. After the final impression has been poured and the "master cast" has been separated from the impression, the next requirement is to obtain the correct biting relationships. To get these biting relationships, the dentist uses baseplates and bite rims. By biting relationships, we are referring to the patient's vertical biting depth, the occlusal plane, the midline, the contour and fullness of the lips and cheeks, etc. Your role in this regard is to construct the baseplate and bite rim and combine the two. The first step is to construct the baseplate.

Baseplate. Before adapting the baseplate to the cast, immerse the cast in slurry water (water containing dissolved hydrocal) for a few minutes. The slurry water will act as a separating medium. Then adapt the baseplate to the cast by first being sure it is centered and then using an alcohol torch or Bunsen burner to apply heat and soften the baseplate. With sufficient heat, you can easily adapt the shellac resin baseplate to the cast by using light finger pressure. (CAUTION: To prevent possible burning of your fingers, dip them in water before touching the heated baseplate.) Trim excess baseplate material with a pair of crown and bridge scissors. If there still remains some rough edges, remove them by using a heated wax spatula or by using an arbor band (abrasive band on a rubber wheeled mandrel). At times, baseplates need reinforcement. A paper clip is a handy item for this purpose. They can be easily shaped, heated, and embedded into the baseplate (especially mandibular baseplates).

Most dental officers prefer to have the inside of these baseplates lined with a material that reproduces a close resemblance of the detail shown on the master cast. Such detail cannot be obtained in adequate quality with the baseplate material. The quality desired is called stabilizing. The stabilizing quality is acquired by using baseplate wax or a final impression wax. Once again, the master cast must be soaked in slurry water before the stabilizing material is added. The wax (baseplate wax) is added by heating the wax until it is in a liquid state, then dipping the soaked cast in the wax. The baseplate is then quickly readapted over the wax. The result is a baseplate lined with wax. Final impression materials may also be added to the baseplate and adapted to the cast to get the stabilizing effect.

Bite rims. Bite rims are usually made with baseplate wax. You may form them by hand or with a two-piece former. To form bite rims using the former, heat a sheet of baseplate wax until it is in a semiliquid state, assemble the bite rim former and place it on a flat surface (glass slab or metal bench top), and press the wax into the former, as shown in figure 6-7, A. Once the wax has cooled to the solid state, remove any excess with a knife, as shown in figure 6-7, B. Now you may disassemble the former and remove the bite. You may then adapt the formed bite rim to the stabilized baseplate by using an alcohol torch, heated wax spatula, and more baseplate wax to act as a bonding material, as shown in figure 6-7, C, and D. If you are forming the bite rim by hand, heat a sheet of baseplate wax until surface melting is apparent; then quickly roll the wax into a cylinder shape. Next, bend the wax cylinder into a horseshoe that coincides with the occlusal surface of the baseplate. Attach the bite rim in the same manner as previously described, and use a compound knife and wax spatula to properly shape the bite rim.

Exercises (499):

1. What is meant by biting relationships?

2. What is used to get the correct biting relationships?

3. Why should you immerse the cast in slurry water before adapting the baseplate to the cast?

4. Briefly describe how to adapt the baseplate to the cast.

5. What is a handy item use in reinforcing baseplates?

6. Briefly describe how you stabilize the baseplate with baseplate wax.

7. What material is used to construct the bite rim?

8. What is used as the bonding material for attaching the bite rim to the baseplate?

9. Briefly describe how the wax is shaped when you fabricate the bite rim without the aid of the two-piece former.

6-7. Orthodontic Section

Orthodontics is the specialty of dentistry that deals with the position of teeth in relation to the dental arches and to each other. It includes evaluation of that relationship and treatment, if required, to improve it. Treatment may involve guidance of the development of the arches or the repositioning of teeth either by functional or mechanical means.

The name orthodontics brings to the mind of most people the "braces" you so often see on the teeth of teenagers. While these "braces," which are more properly called orthodontic appliances, represent the essence of orthodontics, there are more services provided by orthodontists. There are a variety of reasons why people seek orthodontic treatment. Perhaps the biggest reason is appearance. The appearance of the teeth, if unpleasant to the patient, can cause psychological problems. Another factor is a deformity which impairs the dentition function. If a person cannot chew or speak adequately due to a malalignment of the teeth, the orthodontist may be able to correct the problem. What is most desirable is for an orthodontists to treat situations in their early stages. If an orthodontist can bring about the proper alignment of patient's teeth by early extractions and guidance, more complex treatment may be avoided later.

500. Identify the various procedures performed in the orthodontic section.

Preventive Orthodontics. This refers to recognizing and eliminating causes of irregularities in the occlusion as they develop. Treatment of caries is one of these steps since interproximal decay removes tooth structure at the point of contact of adjacent teeth. Such a loss can allow the teeth to drift from their normal position. Correction of oral habits, such as thumb sucking, is another phase of preventive orthodontics. Helping a patient get rid of such a bad habit may keep the occlusion from becoming altered.

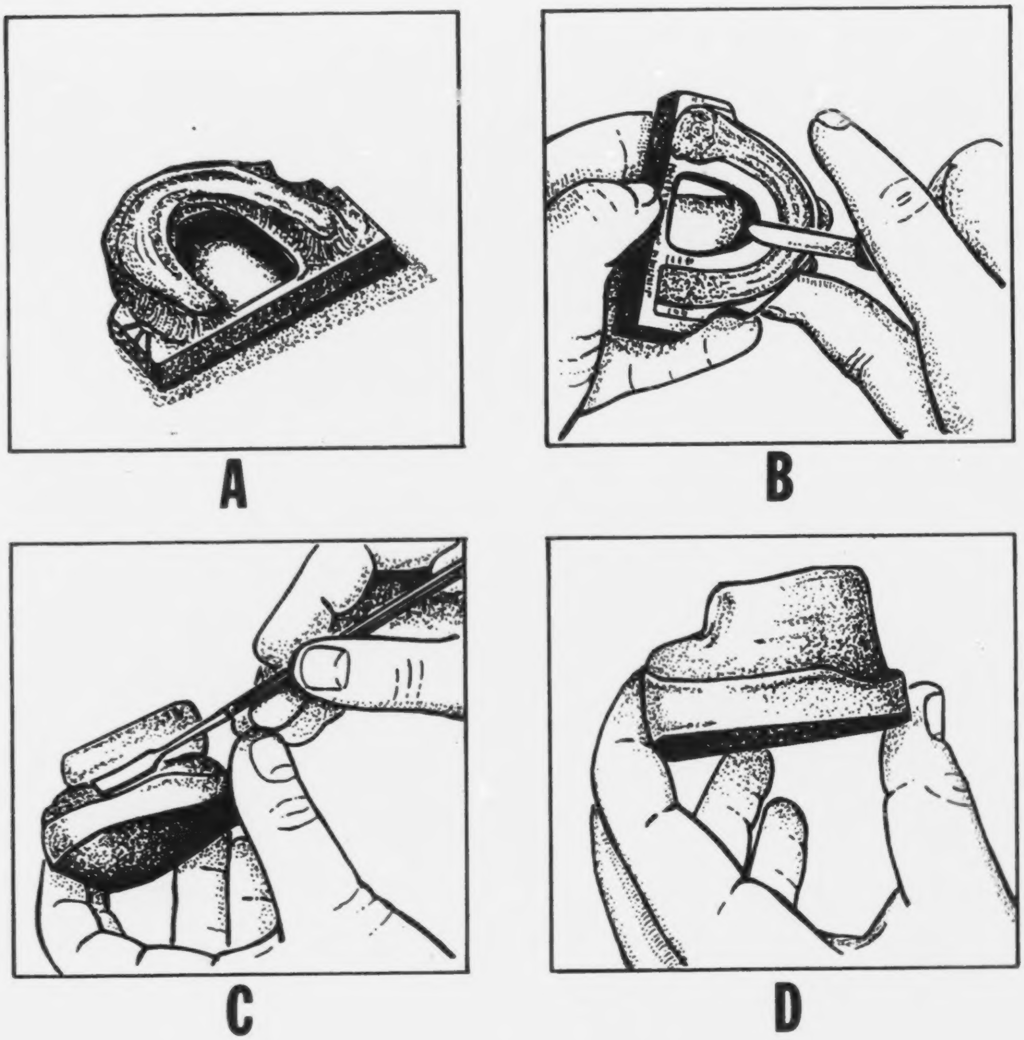


Figure 6–7. Bite rims.

Interceptive Orthodontics. There is a fine line dividing preventive and interceptive orthodontics. The procedures below refer to actions taken to prevent more complex orthodontic problems.

Serial extraction. This is the early removal of primary or permanent teeth to allow room for the remaining teeth to errupt in a more orderly arrangement. It is usually done when there is inadequate room for all the teeth to come in their normal arrangement.

Space maintenance. When a tooth is lost, the adjacent teeth tends to drift into the space left. So, if a child loses a primary tooth so early that the permanent successor is not yet ready to come in and if the adjacent teeth drift or tip into the space left by the early loss, the permanent tooth may be trapped in the bone and thus not able to come into its normal position. To prevent this tipping or drifting into the space, the dentist may insert a space maintainer.

Space maintainers may be fixed or removable. They will be same type of device which will occupy or hold open the space for the permanent tooth until it errupts into place. For space maintenance to be effective, the dentist must see the child shortly after the primary tooth is lost.

Space regaining. If the adjacent teeth have already drifted into the space left by a lossed tooth, space regaining is called for. An appliance to regain teeth will exert pressure on the offending teeth to push them gently back out of the space into which they have migrated. This may be done by the use of springs or elastics.

Crossbite control. Normal arrangement calls for the facial aspect of the maxillary teeth to be located facial to the mandibular teeth. If a maxillary tooth is somehow diverted so that its position is lingual to the mandibular teeth, it is said to be in crossbite. One, or many teeth may be in crossbite. Correction of this situation attempts to move the malpositioned tooth back to the facial position in relation to the mandibular teeth.

Corrective Orthodontics. This procedure is the complex treatment involving the wearing of appliances for long periods of time. The principle upon which tooth movement is based is that a sufficient force applied for a sufficient period of time may cause a tooth to move through bone to a new position. The appliances fabricated by the orthodontist are designed to move the tooth by applying a force in a specific direction.

To apply these forces to the teeth, it is normally necessary to create some attachment for the appliance on the teeth. Traditionally, this has been done by forming bands for each tooth to be moved and for other teeth to be used as abutments for applying the force. Brackets are soldered to the bands. The spring wire or elastics are then engaged by the brackets to receive the force. Recent developments have brought about the frequent use of brackets that can be bonded directly to the teeth, thus eliminating the need for the bands.

Exercises (500):

1. Identify the procedures performed in the orthodontic section by matching the procedure description in column A to the appropriate procedure listed in column B.

Column B

a. Preventive orthodontics.
b. Interceptive orthodontics.
c. Corrective orthodontics.

Column A

_____ (1) The complex treatment involving the wearing of appliances for long periods of time.
_____ (2) May involve serial extraction, space maintenance, space regaining and crossbite control.
_____ (3) Recognizing and eliminating causes of irregularities in the occlusion as they develop.

501. State orthodontic assisting procedures.

Assisting Procedures. The way you assist in the orthodontic section will be similar in many ways to the procedures you followed in the prosthetic section. This may include making impressions, pouring casts, trimming casts, and assisting with the cementation of the appliances. Normally, the cementation of bands or space maintainers will be similar to the cementation of fixed partial dentures or crowns. The directions we gave you earlier for mixing cements apply here.

As an assistant in an orthodontic section, you will have a variety of instruments to handle that are unique to orthodontics. There are numerous pliars used for band forming, band removal, ligature tying, wire bending, safety wire cutting, etc. In addition, there are band seaters, elastics, brackets, etc. These items are so numerous that to try to show them all would take pages. As an orthondontic assistant, you need to know the style of the dental officer you work with.

The orthodontist may ask you to do coronal polishing before the bands are cemented or the brackets bonded. The purpose is to remove debris from the teeth. The cement will not hold as well if there is debris on the teeth.

You also may be called on to remove cement. After the bands or appliances have been cemented, the excess which has oozed out around the edges of the band must be removed. Use a flexible explorer or scaler to remove the cement. Be careful to avoid scratching the bands or injuring the gingival tissues. After removing the excess cement, let the patient rinse his or her mouth.

Exercises (501):

1. Assisting procedures in the orthodontic section are similar in many ways to assisting procedures required in what other section?

2. How are these two sections similar?

3. What are pliars used for in the orthodontic section?

4. Why should coronal polishing of the crowns of the teeth be done prior to cementation of the band or bonding of the brackets?

6-8. Pedodontic Section

Pedodontics is the specialty of dentistry which deals with the teeth of children. More specifically, it usually means treatment of the teeth through erruption and the mixed dentition stage. Mixed dentition is the period when children have both primary and permanent teeth.

502. State the functions of the pedodontic section and describe procedures followed in this section.

Pedodontic Procedures. The predodontist provides the same basic treatment as other specialties. The difference is that the pedodontist treats children, which, of course, brings a special set of challenges.

Young children are often much more expressive of their fears than adults. This results in some management problems unique to the pedodontic section. Young children may fear separation from their parents, unknown settings such as the dental operatory, strange people, and unknown situations. They often react much more vigorously to discomfort or fatigue. The imagination of a youngster may conjure up wild expectations of what will happen in the dental chair. These traits may result in a less cooperative, more fearful patient.

Another complicating factor in pedodontics is the behavior of the parent. The majority of parents present a rational behavior regarding the treatment of their children, but at times they are quite anxious. This is especially true if the child has suffered a severe dental related illness or a traumatic injury. Some parents also may be overindulgent, overanxious, domineering, etc. The complicating behavior of such parents may well increase the management difficulty of a young patient.

Operative. Operative dentistry is done generally as it is for older patients, but cavity preparation is modified somewhat due to differences in the anatomy of the primary teeth as compared to that of permanent teeth. The pulp of a primary tooth is generally much closer to the surface. This factor requires extra caution by the operator to avoid mechanical exposure during cavity preparation. Also, the roots of the primary molars are widely spread and span the crown of the permanent tooth developing under them.

Endodontic. Carious or mechanical exposure of permanent teeth are often treated by either pulp capping or endodontic therapy, depending on the extent of the injury to the pulp. On primary teeth, however, a pulpotomy is much more common. Endodontic therapy is much more difficult since the root tips have not formed the apex completely. Pulpotomy procedures were discussed in the section on endodontics.

Prosthodontic. Prosthodontic procedures are sometimes done on children. In cases where missing teeth present an esthetic problem, plastic removable partial dentures known as flippers are often used to replace the teeth until either the permanent tooth errupts or the patient reaches an age where he or she is better able to tolerate complicated prosthetic treatment. These "flippers" are often used to replace prematurely lost maxillary anterior teeth.

Cast crowns are not normally done on a tooth that will exfoliate within a few years. Much more common in a pedodontic practice is the use of stainless steel crowns on posterior teeth and polycarbonate crowns (white plastic) on anterior teeth. These are much less expensive than castings and will usually last a few years until the permanent tooth errupts or the more sophisticated crown can be made. In addition, these crowns are much simpler to replace than are cast crowns.

Orthodontic. Interceptive orthodontic procedures or space maintenance is a common practice of the pedodontist. These techniques were discussed in the section on orthodontics.

Preventive dentistry. Preventive dentistry is of great importance in the pedodontic section. This is especially true for two reasons. The first is that the primary teeth preserve the space for and provide a pathway of erruption for the permanent teeth. This function, if not properly preserved, can result in unusual crowding situations in the late dentition. Second, since the oral care habits and attitudes are forming in the youth, proper preventive training can prepare an individual for a much more dentally trouble-free life if accepted by the patient.

Brushing techniques are often well taught to the children. If they gain a feeling of the importance of personal oral hygiene, these habits may carry over into adulthood. Parents are often taught to brush the teeth of the children for them until they develop the necessary manual dexterity to do it for themselves.

Proplylaxis procedures followed by topical fluoride application are frequently done on children. This supplements the child's or the parent's efforts to preserve the health of the teeth while the child develops the ability to care for his or her own teeth.

Application of pit and fissure sealants is a procedure that has recently gained favor in prevention. It is particularly suited for the errupting permanent molars and premolars. This involves as acid etching of the occlusal surface of a noncarious permanent tooth with an acid. An adhesive sealant is than applied to the tooth and cured. This forms a hard, adherant barrier to the entry of decay producing contaminants to the tooth.

Oral surgery. Oral surgery procedures on the pedodontic patient often involves treatment of injuries. Children are much more prone to facial injuries. Broken teeth and the associated soft tissue injury require prompt care.

Exercises (502):

1. List four possible fears young children may experience when in the dental clinic.

2. Name some negative behaviors parents exhibit that may effect a child's dental care.

3. What is the difference between the pulp of a primary tooth and the pulp of a permanent tooth?

4. What type of endodontic treatment is done in the pedodontic section?

5. What are flippers used for in children?

6. List two reasons preventive dentistry is of great importance in the pedodontic section.

7. What type of oral surgery procedures are performed on the pedodontic patient?

503. State the correct approach to pedodontic procedures, and specify your responsibilities as a pedodontic assistant.

Assisting Procedures. The way you assist in the pedodontic section is similar to what we discussed in operative dentistry. You will need good chairside techniques of aspiration, retraction, and the ability to properly prepare instruments, supplies, and mix materials. You'll mix the impression materials used in the same manner as described in the section on prosthodontics. A few aspects of pedodontic assisting deserve separate mention at this point.

Rubber dam. Always keep a rubber dam handy when dealing with children. They are much more likely to swallow or aspirate debris in the mouth than older patients. The rubber dam decreases the risk. It also tends to quiet the child. Since with a rubber dam there is often no accumulation of fluids and material scraps in the throat, the child is not bothered with a lot of material in the back of his or her throat. The rubber dam also protects the child from materials used in pulpotomies, and makes it easier to dry the teeth for acid etch procedures.

Stainless steel crowns. As mentioned earlier, stainless steel crowns are usually an ideal substitute for cast restorations of the primary teeth. These crowns usually come in a set with a variety of sizes. The dentist may ask you to select the crown for the tooth he or she is working on. Keep in mind that if you select the wrong size, you'll have to sterilize the crown before returning it to the set.

When the dentist has adjusted the crown so that the fit is satisfactory, it is time to cement it. Many pedodontists use zinc phosphate cement. The mixing and filling of the crown is done the same as described earlier. After cementation, you may be asked to remove the excess cement. Follow the same procedures as for orthodontic bands.

Patient instruction. Patient instruction is very important in the pedodontic section. Normally, this is the dentist's responsibility, but it will often be yours. In talking with children and their parents, there are two major areas you need to stress—the danger of bitting or chewing while the mouth is numb and the importance of not eating, drinking, or rinsing following fluoride application.

Young children are naturally intrigued by the feeling of numbness. Because of this, they may purposefully bite themselves to sense the unusual feeling. They also may bite themselves accidentally. Many children have injured themselves badly in this manner. Stress to the parents that if the child must eat to give him or her something liquid since this requires no chewing.

The problem with fluoride treatment is that children are often less tolerant of the fluoride taste than adults. So, they often want to eat, drink, or rinse to get rid of the taste. Stress to the parents and to the children that they must resist this urge if the treatment is to do its job.

Patient management. Managing children and their parents is a difficult aspect of pedodontics. Parents need to be reassured that their child will receive the best possible professional care, and that they need not concern themselves for the child's welfare while in the dental clinic.

In dealing with children, take a positive approach. Most children will respond well if you take them by the hand and lead them kindly, but firmly into the treatment area. The parent should wait in the reception room during treatment unless the dentist asks the parent to accompany the child.

Exercises (503):

1. When working on pedodontic patients, what risk is decreased by using a rubber dam?

2. As an assistant, what are your duties concerning the cementation of stainless steel crowns?

3. Name two important factors to tell pedodontic patients or their parents.

4. What type of approach is often needed with children?

Bibliography

ECI Course

CDC 98150, Volume 1, *Administration, Safety, and Maintenance*. Volume 3, *Dental Instruments and Materials*. Extension Course Institute, Gunter Air Force Station, Alabama, 36118.

Books

Torres and Ehrlich. *Modern Dental Assisting*, 2nd ed. Philadelphia, Pennsylvania: W. B. Saunders Company, 1980.

Answers for Exercises

CHAPTER 1

Reference:
400 – 1. Inattentiveness, indifference, or abruptness.
400 – 2. A pleasant disposition, tact, calmness, courtesy, and an efficient manner.
400 – 3. Achievement, affection, recognition, and security.
400 – 4. (1) b.
  (2) c.
  (3) d.
  (4) a.
400 – 5. a. T.
  b. F. A relaxing atmosphere should be established.
  c. T.
  d. F. Always use tact and diplomacy when dealing with an upset patient. Guard against losing your temper.

401 – 1. F. There are certain difficulties.
401 – 2. T.
401 – 3. F. You should put a smile in your voice.
401 – 4. F. Answer the phone promptly. A good rule is to try to answer by the third ring.
401 – 5. F. You should always doublecheck all specific information given or taken on the telephone.
401 – 6. T.
401 – 7. F. Never diagnose on the telephone; diagnosis is not your function.
401 – 8. F. Never prescribe on the telephone.
401 – 9. T.

402 – 1. Look at his or her identification card.
402 – 2. (1) a.
  (2) b.
  (3) a.
  (4) a.
  (5) a.
  (6) a.
  (7) a.
  (8) b.
402 – 3. General dental attendance.
402 – 4. Retired members.
402 – 5. a. 3.
  b. 2.
  c. 3.
  d. 1.
  e. 2.
  f. 3.
402 – 6. The dental officer in charge.
402 – 7. Diagnostic dental radiographs.
402 – 8. Emergency treatment.

403 – 1. They use an appointment book and an appointment slip. Most have a system based on a time period.
403 – 2. The base dental surgeon.
403 – 3. AF Form 1223a, Dental Appointment Register.
403 – 4. AF Form 1223, Dental Appointment Register.
403 – 5. AF Form 490.

404 – 1. (1) To insure the currency of dental health classification.
  (2) To check the proper custody of the dental health record.
  (3) To make early detection of dental-oral pathology.
404 – 2.
  (1) Furnishes dental clinics with rosters of officers and airmen in accordance with their organizations and date of last examination.
  (2) It furnishes the organizational units with rosters and annual dental examination notification cards.
404 – 3. (1) Screen the dental health records.
  (2) Advise each concerned organizational unit of the personnel who require a dental examination.
404 – 4. (1) They coordinate the scheduling with the dental clinic.
  (2) Annotate notification cards to advise members when to report for examinations.
  (3) Send the annotated cards to the members.

405 – 1. To insure uniformity in nomenclature and definitions.
405 – 2. Type 1. It is so comprehensive that it is not always practical to perform this examination for all patients.
405 – 3. When the dental officer considers it is needed.
405 – 4. Type 4.
405 – 5. A panoramic radiograph and a polaroid color photograph are made of the patient. The photograph must include both dental arches from the entire occlusal aspect.

406 – 1. C.
406 – 2. B.
406 – 3. C.

407 – 1. Anyone who touches the record.
407 – 2. The base dental surgeon.
407 – 3. The base dental surgeon.
407 – 4. When it is not administratively feasible to maintain custody of the dental record, the dental surgeon may recommend that they remain with the custodian of the unit personnel records group.
407 – 5. Dental officers.

408 – 1. Transitory.
408 – 2. AF Form 2100 series.
408 – 3. a. P.
  b. P.
  c. T.
  d. T.
  e. P.
  f. P.

409 – 1. The first three categories are for Air Force, Army, Navy, and Marine Corps active duty personnel; the fourth is for nationals of foreign governments; and the fifth is for all other personnel.
409 – 2. By the terminal digit filing method, using the individual's Social Security account number.
409 – 3. (a) Use cardboard mounts with the required patient data entered on the mounts.
  (b) Use small envelopes and enter identifying patient data in the space provided.
409 – 4. The loss of radiographs is greatly reduced when this method is used, because they cannot fall out of the folder during transportation or filing.

410 – 1. When there is a possibility that it could be misinterpreted.
410 – 2. a. 2.
  b. 21.
  c. 11.
  d. 9.

e. 5.
f. 17.
g. 3.
h. 25.
i. 22.

410 – 3. MODF.

410 – 4.
a. Equil.
b. XR.
c. Pedoni.
d. Abs.
e. Uner.
f. Tem.
g. Rpd.
h. GP.
i. Par.
j. Man.
k. NUG.
l. Abr.
m. Cal.
n. Alvy.
o. Pr.
p. Gtmy.
q. POT.
r. Dtr.
s. Pitis.

410 – 5.
a. Car #13—MO BAm.
b. Car #3—MOD BAm.
c. Pitis acute #5—Fil Zno Eug.
d. Def Fil Dec #18—MOD Am.
e. Abs Per acute severe #8—Ext Anes Reg.

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411 – 1.

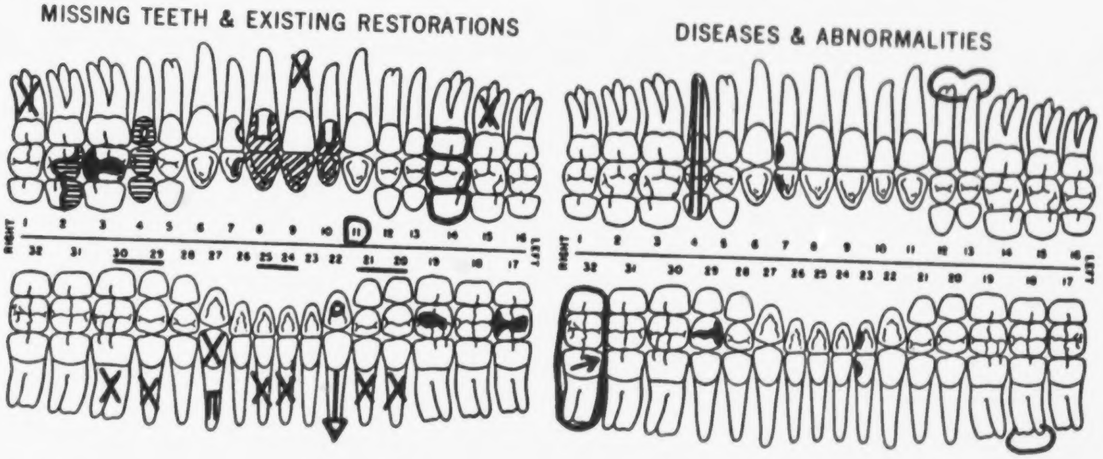

Figure A–1. Objective 411, exercise 1.

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412 – 1. Social Security account number.
412 – 2. According to the last two digits of the applicable SSAN.
412 – 3. 40.
412 – 4. "S" indicates active duty military, "R" indicates Army personnel.
412 – 5. By entering the date the patient was placed into the program (in pencil).
412 – 6. The word "Fly" in 2-inch block letters in the upper left-hand corner of the front leaf of the folder.
412 – 7. 9999.

413 – 1. 100.
413 – 2. The record has a different color. The diagonal pattern of the blocking is broken.
413 – 3. AF Form 614, Charge Out Record.
413 – 4. Nonmilitary and retired military personnel.
413 – 5. The authorization should be completed.

414 – 1. The patient can be located on the Worldwide Locator available on microfiche at the CBPO or the outpatient section of the medical treatment facility.
414 – 2. For as long as the sponsor's record is available.
414 – 3. The base dental surgeon.
414 – 4. Sent it on AF Form 644, Record of Dental Attendance.

415 – 1. The purpose for which the information will be used and their rights, benefits, or obligations with respect to supplying the data.
415 – 2. Individuals from whom information is collected for inclusion in medical records.
415 – 3. Say so on the form.
415 – 4. As the bottom document on the left side of the treatment record.

416 – 1. It is a chronological record of a person's dental condition during his or her period of military service. It is used to verify an individual's dental condition and treatment and it is an important source for identifying deceased personnel.
416 – 2. When definitive care is provided to any patient.
416 – 3. (1) Initial record.
(2) No record available.
(3) Short Tour (active duty or training).
(4) Temporary SF 603.
(5) Dental Identification.
(6) Physical Examinations.
416 – 4. A dental officer.
416 – 5. Print the entries in black or blue-black ink.
416 – 6. The time of the original examination.

416 – 7. Subsection 15, Restorations and Treatments; Subsection 16, Subsequent Diseases and Abnormalities; and Subsection 17, Services Rendered.

416 – 8. Subsection 17, Services Rendered.

416 – 9. Subsection 15, Record only treatment rendered or indicated in Section 17 of SF 603a.

417 – 1. T.

417 – 2. T.

417 – 3. T.

417 – 4. F. All histories with relevant positive entries are retained in the patients dental folder.

418 – 1. To provide the information necessary for maintaining patient's individual dental health records and (2) to provide statistical data for the dental service report, thereby informing higher headquarters of the dental procedures performed by your clinic.

418 – 2. Because AF Form 644 provides information for keypunching.

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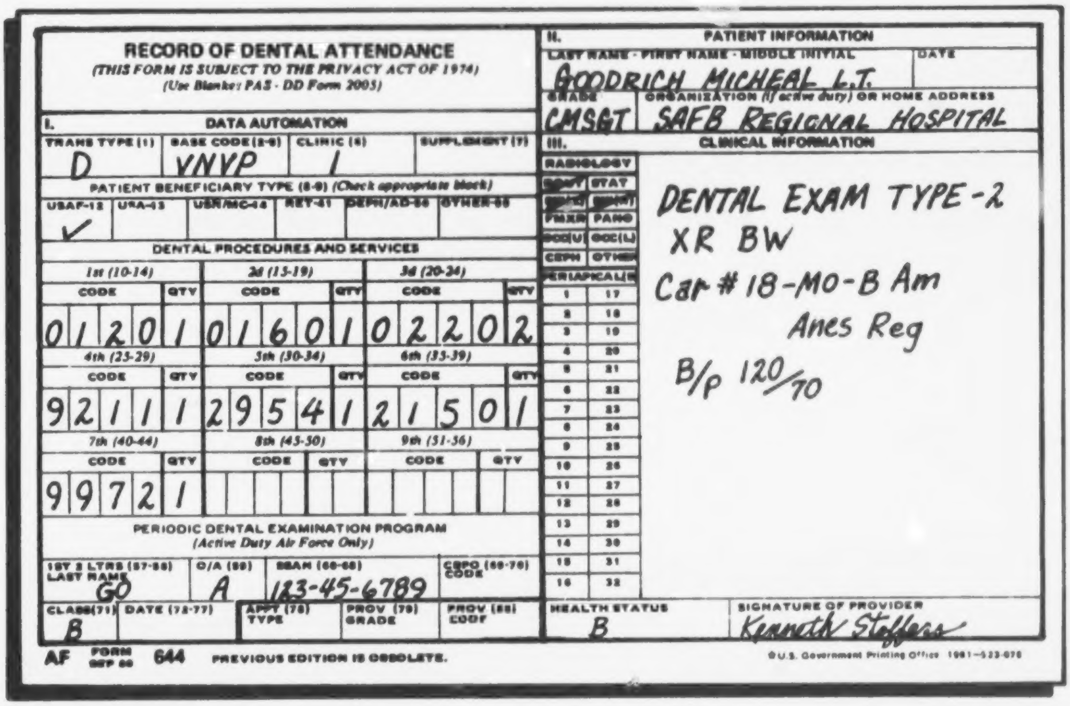
418 – 3.



RECORD OF DENTAL ATTENDANCE

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974)

(Use Blanket PAS - DD Form 2005)

I. DATA AUTOMATION

TRANS TYPE (1)	BASE CODE (2-5)	CLINIC (6)	SUPPLEMENT (7)
D	VNVP	1	

PATIENT BENEFICIARY TYPE (8-9) *(Check appropriate block)*

USAF-12	USA-13	USN/MC-14	RET-41	DEPN/AD-56	OTHER-55
✓					

DENTAL PROCEDURES AND SERVICES

1st (10-14) CODE	QTY	*2d (15-19)* CODE	QTY	*3d (20-24)* CODE	QTY
0120	1	0160	1	0220	2

4th (25-29) CODE	QTY	*5th (30-34)* CODE	QTY	*6th (35-39)* CODE	QTY
9211	1	2954	1	2150	1

7th (40-44) CODE	QTY	*8th (45-50)* CODE	QTY	*9th (51-56)* CODE	QTY
9972	1				

PERIODIC DENTAL EXAMINATION PROGRAM *(Active Duty Air Force Only)*

1ST 2 LTRS (57-58) LAST NAME	O/A (59)	SSAN (60-68)	CBPO (69-70) CODE
GO	A	123-45-6789	

CLASS (71)	DATE (72-77)	APPT (78) TYPE	PROV (79) GRADE	PROV (80) CODE
B				

II. PATIENT INFORMATION

LAST NAME - FIRST NAME - MIDDLE INITIAL	DATE
GOODRICH MICHEAL L.T.	

GRADE	ORGANIZATION *(If active duty)* OR HOME ADDRESS
CMSGT	SAFB REGIONAL HOSPITAL

III. CLINICAL INFORMATION

RADIOLOGY	
[illegible]	STAT
[illegible]	[illegible]
FMXR	PANO
OCC(U)	OCC(L)
CEPH	OTHER
PERIAPICAL(S)	
1	17
2	18
3	19
4	20
5	21
6	22
7	23
8	24
9	25
10	26
11	27
12	28
13	29
14	30
15	31
16	32

DENTAL EXAM TYPE-2
XR BW
Car # 18-MO-B Am
Anes Reg
B/P 120/70

HEALTH STATUS	SIGNATURE OF PROVIDER
B	Kenneth Steffens

AF FORM SEP 80 644 PREVIOUS EDITION IS OBSOLETE.

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Figure A–2. Sample, AF Form 644, Record of Dental Attendance objective 418, exercise 3).

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419 – 1. T.

419 – 2. F. The system must be rational and applicable to all patients incorporating recommendations of the various dental specialties into a final plan before definitive treatment is instituted.

419 – 3. F. The oral surgery phase should be placed before the soft tissue phase.

419 – 4. T.

419 – 5. T.

419 – 6. F. Only general information and avoidance of dental abbreviations.

420 – 1. It provides a basic periodontal examination, diagnosis and treatment planning record for periodontal therapy.

420 – 2. It becomes a permanent part of the patients dental record.

420 – 3. The patients periodontal status before, during, and after active periodontal therapy.

420 – 4. AFR 162–1.

421 – 1. T.

421 – 2. F. It is used to request X-ray examinations other than dental X-ray services.

422 – 1. (1) c.
(2) d.
(3) d.
(4) a.
(5) a.
(6) b.

423 – 1. Standard Form 88, Report of Medical Examination, and Standard Form 521, Clinical Record—Dental.

423 – 2. The purpose of the medical physical will already have been noted on the SF 88 initiated by the hospital; from this purpose, the type of dental examination is determined.

423 – 3. No. It is a part of the hospital records maintained for the patient; however, the dental treatment record on it should be summarized and the summary should be entered on the dental health record.

423 – 4. So that any dental care provided does not interfere with the patient's medical treatment.

424 – 1. It helps to keep Dental Services strength at the proper level, evaluate the effect of, or the need for, improvements in the

organization, procedures, methods, equipment, training, and professional education in the clinic. The report also supports current personnel staffing, forecast requirements pertaining to professional care, manpower, equipment, facilities, and training.

424 – 2. a. Part 1 contains the total dental procedures and services provided to patients by dental care providers. The input data depicts the full health care delivery of a dental activity. Dental managers use this report for budgeting and operations planning. AFM 162–693 covers procedures for completing this part of the dental service report.

b. Part 2 summarizes the professional capabilities, availability and management of dental personnel resources. It identifies all key personnel, officers, enlisted and civilians assigned to the clinic. Also laboratory technicians with special experience identifiers, the number of cases mailed to area dental laboratorys, Red Cross volunteers mandays, and time utilization of military and civilian employees.

c. Part 4 provides general information on dental research activities. It is prepared by dental officers engaged in clinical research.

d. Part 5 is submitted by all dental personnel on extended active duty who attend a training course in a civilian or military institution.

e. Part 6 provides information requirements and normally covers the entire course length. Long courses are submitted quarterly.

425 – 1. The budget sets the final pattern for the financial operation of a clinic for an entire year.
425 – 2. The age and condition of the equipment must be known. In order to determine if a replacement or new item is to be requested.
425 – 3. The dental service's Medical Expense Report, RSC: HAF–SGD (Q) 7104.

426 – 1. To publish objective, comprehensive, and accurate accounts of Air Force activities.
426 – 2. The Office of the Surgeon General.
426 – 3. The significant developments in military medicine and their contributions to operational effectiveness.
426 – 4. It is incorporated in the history of the medical unit.

427 – 1. (1) c.
(2) d.
(3) b.
(4) a.

CHAPTER 2

428 – 1. (1) a.
(2) b.
428 – 2. AFR 0–2.
428 – 3. A regulation.
428 – 4. That this is the first departmental regulation that has been issued for this subject series.
428 – 5. AFR 0–9.
428 – 6. Local reproduction authorized.
428 – 7. That the information has changed or a new form has been issued since the last edition of the index.
428 – 8. Consult the last section of AFR 0–9 to learn what you should do with the obsolete forms on hand.

429 – 1. Expendable items are those items for which all accountability is dropped from the records when they are issued. Nonexpendable items are those items that retain their identity throughout the period of their use and for which accountability must be maintained on official records.
429 – 2. The group.
429 – 3. The class.
429 – 4. Specific items in the group.
429 – 5. (1) c.
(2) f.
(3) a.
(4) g.
(5) d.
(6) e.
(7) b.

430 – 1. T.
430 – 2. F. You are responsible for keeping your Federal Supply Catalog.
430 – 3. T.
430 – 4. T.

431 – 1. The table of allowances (TAs).
431 – 2. To tell what each clinic may procure in order to perform its mission.
431 – 3. TA 891, Dental Clinic, and TA 892, Dental Laboratory.
431 – 4. The number of people the clinic serves.
431 – 5. A working level that normally does not exceed a 2-week supply.
431 – 6. The base medical supply activity.

432 – 1. Each supply item has a maximum level and reorder point. When the shelf supply reaches the reorder point, you order the quantity needed to bring the shelf supply back up to the maximum level.
432 – 2. The base medical supply officer.
432 – 3. Because any items listed on the issue document will be charged against your account, whether you receive them or not.
432 – 4. In stock number sequence.
432 – 5. Local policies.
432 – 6. The medical supply officer.
432 – 7. MEMO.
432 – 8. To reveal whether or not (1) items and quantities on hand are adequate, (2) items on hand are fit for use, and (3) established levels are realistic.
432 – 9. Annually, or more often if this is considered necessary by the base dental surgeon, the medical supply officer, or higher authority.
432 – 10. Narcotics and alcohol must be inventoried at least monthly, and items such as precious metals must be inventoried at least quarterly.
432 – 11. A disinterested officer, or an NCO in the top three grades who has been appointed by the director of Base Medical Services.
432 – 12. Medical Supply.

433 – 1. Every Air Force member.
433 – 2. It is in no way lessened.
433 – 3. Personnel who have property responsibility must pay for the loss, damage, or destruction of property resulting from their maladministration or negligence in the use, care, custody, or safeguarding of such property from causes other than fair wear and tear.
433 – 4. The finder.
433 – 5. Property may be turned in to Base Supply as excess; it may be transferred from one organization or person to another; or, in the case of damaged or lost items, the person who has custody may be liable and may be required to pay for them.
433 – 6. A written record of the transfer of the property responsibility must be made.

434 – 1. (1) d.
(2) a.
(3) c.
(4) b.
434 – 2. The appointing authority and the investigating officer.
434 – 3. The person responsible for the custody of the property in question may or may not be required to pay for it.

435 – 1. The medical equipment maintenance section.
435 – 2. Medical Supply may schedule repair by a civilian firm, send the equipment to a base having repair facilities, or schedule a visit by a medical equipment repairer from your support base.
435 – 3. The base civil engineering group.
435 – 4. Minor emergency repairs.
435 – 5. A work order request must be submitted by the hospital engineer.

CHAPTER 3

436 – 1. Handle, shank, and working end.

436 – 2. Nib.
436 – 3. The purpose of the instrument; the position or manner of use; the shape of the working end; and the angle to the working end in relation to the handle.
436 – 4. Normally, on the portion of the handle farthest from the working end of single-ended instruments and near the center on double-ended instruments.
436 – 5. The formula number.

437 – 1. A. Vitalometer.
B. Dressing forceps.
C. Transilluminator.
D. Clinical thermometer.
E. Dental radiograph.
F. Mouth mirror.
G. Explorer.
437 – 2. a. G.
b. C.
c. B.
d. F.
e. A.

438 – 1. a. A, C, D, F, and G.
b. H, I, and J.
c. B and E.
438 – 2. D and F.
438 – 3. A and H.
438 – 4. E.
438 – 5. I.
438 – 6. B, C, E, G, and J.
438 – 7. G.
438 – 8. C.
438 – 9. a. 901.
b. 33 1/3, 35, 37, and 39.
c. 699, 700, 701, 702, and 703.
d. 1/4, 1/2, 2, 4, 6, and 8.
e. 557, 558, and 559.
f. 169L and 170L.
g. 57.

439 – 1. The shaft upon which an abrasive disk or wheel is mounted.
439 – 2. Safe-sided disk.
439 – 3. To cut tooth structures and smooth and polish restorations.
439 – 4. To smooth and reduce high spots on restorations or prosthetic devices.
439 – 5. Disks are thinner and usually have abrasives on only one side. Wheels usually have abrasives on both sides and on the outer edges as well.
439 – 6. Conventional speed angle or straight handpieces.
439 – 7. Usually used in conjunction with abrasives to remove stains or to polish teeth, restorations, and dental appliances.
439 – 8. They are screwed into the handpiece.
439 – 9. For polishing dentures or other prosthodontic appliances.
439 – 10. Sterilization will affect the abrasive bond of some rotary instruments.

440 – 1. F. The aspirating syringe has a small harpoon on the plunger.
440 – 2. T.
440 – 3. T.
440 – 4. F. It's used to isolate a designated tooth or teeth in the mouth before certain restorative or endodontic procedures.
440 – 5. F. It punches different sizes of holes in the rubber dam.
440 – 6. T.
440 – 7. F. Most rubber dam holders are U-shaped.
440 – 8. T.
440 – 9. F. It is used for precision measuring in the endodontic and prosthodontic treatment rooms and the dental laboratory.
440 – 10. T.

441 – 1. F.
441 – 2. C.
441 – 3. G.
441 – 4. B.
441 – 5. H.
441 – 6. D.
441 – 7. E.
441 – 8. A.

442 – 1. T.
442 – 2. F. It partially encircles a tooth in a horseshoe or U-shape.
442 – 3. F. Come in the incisor, cuspid, and bicuspid shapes.
442 – 4. F. Come in the incisor, cuspid, bicuspid, and molar shapes.
442 – 5. T.
442 – 6. F. They can be heat sterilized along with other dental instruments.

443 – 1. a. B.
b. A and F.
c. D and E.
d. C.
443 – 2. a. D.
b. A.
c. E.
d. C.
e. A.
f. F.
g. B.

444 – 1. The #142. Other spatulas can discolor the mix.
444 – 2. It is a small version for mixing small quantities of cement.
444 – 3. It should be thoroughly cleaned and disinfected.
444 – 4. To transport and place dental cements, resins, and temporary, insulating, and pulp-capping materials.
444 – 5. The #5–7.

445 – 1. The beaks, neck, and handles.
445 – 2. They have a concave inner surface and a convex outer surface, and are shaped to conform snugly to the contour of the tooth.
445 – 3. Two sets of parentheses.
445 – 4. They have a notched beak for the facial side and an unnotched beak for the lingual side of the tooth.
445 – 5. So that the beaks may be placed on the tooth and still be parallel with the long axis of the tooth.
445 – 6. a. B, E, and F.
b. A, C, G, and H.
c. D.
d. A.
e. F.
f. G.
g. B.
h. E.
i. F.
j. C.
k. H.

446 – 1. (1) c.
(2) f.
(3) e.
(4) b.
(5) a.
(6) g.

447 – 1. Scalpels or Bard-Parkers.
447 – 2. Discard it.
447 – 3. a. #12.
b. #10 and #15.
c. #11.
447 – 4. Rongeur forceps.
447 – 5. The bone file.
447 – 6. To remove bone or to split teeth.
447 – 7. The #1 Stout chisel.
447 – 8. Curettes.

448 – 1. A.
448 – 2. B and D.
448 – 3. E.
448 – 4. C.
448 – 5. F.

449 – 1. The #4.
449 – 2. Bulb type and Luer type.
449 – 3. Irrigating syringes.
449 – 4. The surgical mallet.
449 – 5. Small, semicircular shaped.
449 – 6. Silk.
449 – 7. It has forklike prongs.

450 – 1. On the crown portions of the teeth.
450 – 2. U-15-33.
450 – 3. 1/1000 inch.
450 – 4. The handpiece insert converts the electrical energy into sound waves or vibrations.

451 – 1. B.
451 – 2. E.
451 – 3. C, D, and F.
451 – 4. A.
451 – 5. G.
451 – 6. C.
451 – 7. G.
451 – 8. D and F.
451 – 9. B.
451 – 10. E.
451 – 11. A.

452 – 1. Root canal broach.
452 – 2. Root canal reamer.
452 – 3. Root canal file.
452 – 4. The file threads are finer and closer together.
452 – 5. One type has contra-angle working ends, and the other has straight working ends.

453 – 1. The aluminum tray.
453 – 2. The compound knife.
453 – 3. The crown remover.
453 – 4. Methyl (wood) alcohol.
453 – 5. The roach carver.
453 – 6. The dental pliers.
453 – 7. The Beale #7 and the Gritman #31.
453 – 8. A rubber mixing bowl.
453 – 9. Collar and crown scissors.
453 – 10. Rimlocking impression trays.

454 – 1. A sharp edge will reflect no light.
454 – 2. T.
454 – 3. Soak it in an ammonia-water solution.
454 – 4. You should pull the blade back and forth across the stone.
454 – 5. T.
454 – 6. T.
454 – 7. T.

CHAPTER 4

455 – 1. T.
455 – 2. T.
455 – 3. F. Cleaning of dental equipment involves cleaning chrome-plated, painted, stainless-steel, and upholstery surfaces.
455 – 4. T.
455 – 5. F. To clean upholstery surfaces, use lukewarm water and mild soap.

456 – 1. (1) Keeping dirt and filth at the lowest level possible.
(2) Keeping the facility in a presentable condition.
456 – 2. Daily.
456 – 3. Remove dust and micro-organisms by vacuuming carpeting at the end of each duty day. Remove spots by shampooing, if possible. Do not use solvents without consulting your NCOIC.
456 – 4. a. At least weekly.
b. About every 3 weeks.
456 – 5. Local conditions.
456 – 6. (1) Use a stock-listed window cleaner.
(2) Add a small amount of ammonia to water.
456 – 7. Daily.
456 – 8. Make certain that the electrical switch is in the OFF position.
456 – 9. With a soft, dry cloth—daily.
456 – 10. They are dry-cleaned.

457 – 1. T.
457 – 2. T.
457 – 3. T

458 – 1. (1) b.
(2) a.
(3) c.
(4) d.
(5) d.

459 – 1. Only slightly, since they differ in design, shape, and manufacture.
459 – 2. Manuals prepared by equipment manufacturers.
459 – 3. Make a visual inspection for obvious problem areas and follow it with an operational check of the water, air, gas, and electrical systems.
459 – 4. Loose connections and defective washers and valves.
459 – 5. (1) Excessive moisture in the air system. It can be corrected by draining the air tank and purging the air lines daily.
(2) Incorrect air pressure at critical points. It can be adjusted by following the manufacturer's instructions.
459 – 6. Turn them over to medical equipment repair.
459 – 7. Use a silicone spray (dry) lubricant.
459 – 8. Corrosion, with eventual clogging of the entire drainage system.
459 – 9. Clean the screen and run a cup of water through the system.

460 – 1. Manually or electrically.
460 – 2. (1) The exterior surface is clean and well polished.
(2) There are no oil leaks or broken or missing parts.
(3) The upholstery is in good repair, with no tears or other damage.
460 – 3. UP; rise; wobble.
460 – 4. By either an electric motor or a foot-operated lever.
460 – 5. Inner; medical equipment repair.
460 – 6. S.A.E. 20-weight motor oil.
460 – 7. Air.
460 – 8. Apply one drop of lightweight oil every 6 months.

461 – 1. (1) d.
(2) a.
(3) b.
(4) c.
(5) e.
(6) f.
(7) g.

462 – 1. T.
462 – 2. T.
462 – 3. F. The handpiece must be disassembled for this kind of cleaning.
462 – 4. T.
462 – 5. T.
462 – 6. F. The right-angle prophylaxes handpiece should be cleaned after each use; run in cleaner 1 minute forward and 1 minute in reverse. The head is packed with an approved lubricant reassembled and tested.
462 – 7. F. One minute forward and 1 minute in reverse.

463 – 1. (1) b.
(2) a, b.
(3) c.
(4) c.

464 – 1. Changing burned-out bulbs.
464 – 2. Onto the dental operating unit.
464 – 3. A dry towel.
464 – 4. About every 6 months, apply lightweight machine oil to the joints in small amounts.

465 – 1. Morning; grounded; 20; vibration; weekly; monthly.
465 – 2. Oil; muffler; oil; two; clogging; water.
465 – 3. Replace it with a dry one.
465 – 4. Empty it, then put an inch of water in it.
465 – 5. Empty them.
465 – 6. At the end of each day.
465 – 7. Weekly.

466 – 1. Seat; position; caster; monthly.
466 – 2. Clean; shaft; locking.

467 – 1. (1) b.
(2) a.
(3) a.
(4) c.
(5) a.
(6) c.

468 – 1. T.

468 – 2. F. To remove objects unplug the amalgamator and turn it upside down. Gently rotate it back and forth until the object falls out.
468 – 3. F. Do not remove the case. Incorrect replacement can damage the wiring or bearings.
468 – 4. T.

CHAPTER 5

469 – 1. It promotes a feeling of harmony that makes the job more enjoyable and results in a smoother running, more reputable dental service.
469 – 2. By meeting the psychological needs of your patients and coworkers.
469 – 3. Even harmless horseplay can have a negative effect on a patient who is in pain or who is apprehensive.
469 – 4. The spirit of the "Golden Rule."
469 – 5. You should have checked items b, c, e, and h.
470 – 1. (1) Make preparations for patient.
(2) Greet the patient.
2. (3) Seat him or her in the dental chair.
470 – 2. An alcohol sponge.
470 – 3. The basic diagnostic instruments. Arrange them neatly with as few visible as possible.
470 – 4. If the record is complete and current, if it is the correct record, and if positive responses on the dental health history are indicated on the outside of the folder.
470 – 5. Before the patient is seated.
470 – 6. Walk to the waiting room and greet the patient pleasantly by his or her name and rank.
470 – 7. At the door of the treatment room.
470 – 8. Noncontroversial subjects like the weather or the patient's hobbies.
470 – 9. In its lowest position with the bracket table swung out of the way. If the chair has an adjustable backrest and headrest, set them for an average patient.
470 – 10. The occlusal plane of the patient's mandibular teeth.
470 – 11. Maintain a light conversation with the patient, but be extremely careful not to commit the dental officer to a treatment plan he or she cannot fulfill.

471 – 1. The routine and the surgical drape.
471 – 2. To protect the patient's clothing.
471 – 3. The towel chain.
471 – 4. Placed toward the outside. This allows spilled liquids to be absorbed rather than running down the plastic onto the patient's clothing.
471 – 5. When the cavitron is being used.
471 – 6. When there is a good change of contamination.
471 – 7. (1) It prevents the patient from seeing instruments.
(2) Prevents the light from shining in his or her eyes.
(3) Prevents the accidental contamination of the instruments by the patient's hair.
471 – 8. Have the patient lift his or her head from the headrest, lay two sterile towels across the headrest, and have the patient lay his or her head back on the towels. Crisscross the top towel across the eyes and secure it with a towel clamp. Allow the bottom towel to drape naturally around the patient's neck and shoulders. Cover the patient's chest with a drape and secure it at the back of the neck to the bottom head drape with a pair of towel clamp forceps.

472 – 1. The instruments the procedure requires and the ones the dentist prefers.
472 – 2. You can lay them on the bracket table or place them in setup trays or packs.
472 – 3. In their order of use.
472 – 4. In oral surgery.
472 – 5. It is a corrosion-resistant and autoclavable tray. The contents are usually covered with a towel, cloth, surgical wrapper, or suitable metal lid.
472 – 6. Write on the instrument pack the date that the contents will no longer be considered sterile.

473 – 1. To make the operating site insensitive to pain.
473 – 2. (1) c.
(2) l.
(3) b.
(4) f.
(5) a.
(6) d.
(7) e.
(8) g.
(9) k.
(10) m.
(11) j.
(12) h.
(13) i.

474 – 1. The routine of the procedures and the related instruments and the materials required.
474 – 2. A spoken word, a slight to moderate movement of his or her hand, or only a pause in using the instrument.
474 – 3. It should be pointed toward the treatment area.
474 – 4. Knowing when to mix.
474 – 5. To have the needed item at the right place, in the right position, and at the right time.

475 – 1. To give the dentist easier operating accessibility, to allow a better view of the operation site, and to protect the tissues being retracted.
475 – 2. Retractors are helpful in retracting gingival flaps and periosteal elevators may be used on gingival flaps and other oral tissues. The mouth mirror is effective for retracting the tongue, cheeks, and lips.
475 – 3. Pressure firm enough to prevent slippage, but not firm enough to cause unnecessary tissue bruises and trauma.

476 – 1. To maintain a clean field of operation.
476 – 2. Water from the unit's spray system or water syringe.
476 – 3. Normal saline and sterile water.
476 – 4. (1) e.
(2) b.
(3) d.
(4) a.
(5) c.

477 – 1. To gather micro-organisms from a patient and to promote the growth of these micro-organisms.
477 – 2. Endodontic samples are taken by placing and then removing a sterile paper point into the pulp canal. Samples from surgical sites are taken by swabbing the site with a sterile cotton tipped applicator.
477 – 3. Flame the tube.
477 – 4. The penase ascites.
477 – 5. Patient's name, date of the sample, whether it is the first, second, etc., culture taken, description of the sample, and type of report desired.
477 – 6. Whether it is positive or negative.
477 – 7. 37° C or 98.6° F.
477 – 8. Within 48 hours.
477 – 9. Ascites solution appears cloudy and gelatin exhibits a moldlike growth.

478 – 1. First, you should remove all debris from the patient's face. You may do this yourself or provide the patient with a dampened towel and mirror and let him or her do it. Next, remove the patient's drape and position the chair, operating light, and bracket table so that the patient can easily exit the chair. Return any personal belongings to the patient and arrange for any needed future appointments.
478 – 2. Usually, this can be done during breaks in the chairside assisting routine. If this isn't possible, you should complete the paperwork right after the patient leaves.
478 – 3. All medications and materials must be put back into proper order. Instruments must be scrubbed and sterilized. The equipment should be cleaned and disinfected.
478 – 4. Get any additional supplies or equipment that will be needed for the next patient.

479 – 1. Inventory, ordering, turning in, and storing.
479 – 2. To be sure that you don't run out of supplies during a patient's treatment and that you don't have an excess of materials on hand.

479 − 3. Daily.
479 − 4. Hoarding may deprive others of the supplies they need; it invites thievery, ties up supply dollars needlessly, and may result in loss due to deterioration.
479 − 5. Failure to turn in excess supplies has the same adverse effect as hoarding.
479 − 6. Taking the steps necessary to protect the supply items.

480 − 1. T.
480 − 2. F. Both be seated.
480 − 3. F. Positioned for the convenience of both the operator and the technician.
480 − 4. T.
480 − 5. T.

481 − 1. You should have checked a and d.
481 − 2. You should have checked b, c, and e.
481 − 3. You should have checked a, b, c, and d.
481 − 4. You should have checked b.
481 − 5. You should have checked a and c.
481 − 6. You should have checked a and b.
481 − 7. You should have checked b.

482 − 1. The dentist should be in the 8- to 11-o'clock position and the assistant in the 2- to 5-o'clock position.
482 − 2. The transfer zone.
482 − 3. To the level where the dentist's elbow is as close as possible to the field of operation.
482 − 4. 14 to 16 inches.
482 − 5. 4 to 6 inches above the dentist's eyes.
482 − 6. Toward the head of the chair and so that you have easy access to the needed instruments and materials.

483 − 1. Because of the absence of the cuspidor.
483 − 2. The time lost when the patient expectorates.
483 − 3. So that it adequately evacuates saliva, debris, and water from the oral cavity and yet does not interfere with the dentist's view or access to the operating site.
483 − 4. Since your right hand is busy aspirating, you must learn to pass instruments with your left hand.
483 − 5. By placing the first cutting bur the dentist needs in one high-speed handpiece and the second bur in the other high-speed handpiece.
483 − 6. The treatment routine.

CHAPTER 6

484 − 1. To schedule annual examinations of military members, examination and routing of sick call patients, treatment planning, and special examination in support of the medical mission.
484 − 2. The annual dental examination.
484 − 3. The patient's dental problem is diagnosed and he or she is routed to the appropriate section for treatment.
484 − 4. To provide a systematic approach to clinical dental care.
484 − 5. The foldout located in the back of AFR 162−1, *Management and Administration of USAF Dental Activities*.
484 − 6. The completion of forms.
484 − 7. Because it is the first professional treatment area of the dental clinic to which the patient is exposed.

485 − 1. To restore decayed or fractured teeth to there original functional ability and esthetic quality.
485 − 2. Maintain light conversation with the patient, check his or her dental records, and place the radiographs and treatment records so that they will be convenient to the dental officer.
485 − 3. Wash and dry your hands in full view of the patient, lay out the required instruments, attach the saliva ejector, and turn on and adjust the dental operating light as the dentist approaches the patient.
485 − 4. In case a second injection is required.
485 − 5. By retracting the cheeks or tongue and irrigating and aspirating as required.
485 − 6. When the dental officer is carving and finishing the restoration.
485 − 7. Wash and sterilize them along with the instruments that were used.

486 − 1. (1) e.
(2) h.
(3) b.
(4) g.
(5) a.
(6) d.
(7) f.
(8) c.

487 − 1. Self-confidence has a calming effect on a nervous patient.
487 − 2. To prevent cross-contamination.
487 − 3. You should previously discuss the essentials for each type of operation with the oral surgeon.
487 − 4. The view of the treatment area.
487 − 5. You should place them in a quiet area of the clinic and make sure they are not left alone.
487 − 6. Have him or her loosen restricting clothing and remove and properly store any prosthetic appliances.
487 − 7. Scrubbing with a handbrush and soap.
487 − 8. After.
487 − 9. Most surgical procedures require two or more injections and supplying two syringes will allow you to supply the syringes to the dentist with minimum time lost.
487 − 10. Because the dentist's gloves reduce tactile feeling, thereby increasing the possibility of his or her dropping the instrument.
487 − 11. Because the oral surgeon must be able to see what he or she is doing and the accumulation of blood and saliva in the rear of the patient's mouth tends to excite the patient's gag reflex.
487 − 12. A container of sterile distilled water or saline solution and an irrigating syringe.
487 − 13. A gauze sponge that has been moistened with irrigating solution.
487 − 14. Quietly point it out to the oral surgeon.
487 − 15. Clean the patient's face and remove or cover the blood stained instruments and aspirator bottle.
487 − 16. To make sure that the patient is steady on his or her feet and shows no signs of distress.

488 − 1. The pulp is dead.
488 − 2. To remove the contents of the pulp canal, clear up infection, and insert a root canal filling material.
488 − 3. Because the infection must be completely cleared up before the pulp canal is filled.
488 − 4. Reamers or files.
488 − 5. Rubber dam.
488 − 6. Root canal reamers and files.
488 − 7. A paper point.
488 − 8. To insure that the growth of micro-organisms has ceased.
488 − 9. When you obtain a negative culture.
488 − 10. Gutta-percha or a silver point sealed with root canal cement.
488 − 11. The exact approach your dentist takes toward root canal therapy.
488 − 12. Apicoectomy.
488 − 13. It is removed.
488 − 14. By incising the soft tissue and removing overlaying bone with a bur or chisel.
488 − 15. Curettes.
488 − 16. The surgical assisting procedures.

489 − 1. F. They can cause periodontal disease.
489 − 2. T.
489 − 3. F. Periodontal pockets have no effect on food nutritional values.
489 − 4. T.
489 − 5. F. They contain mostly anarobic bacteria.
489 − 6. T.
489 − 7. T.
489 − 8. (1) b.
(2) e.
(3) d.
(4) a.
(5) c.
489 − 9. Oral surgery.

490 − 1. Periodontal.

490 – 2. To diagnose conditions that must be corrected before the patient starts prosthodonic treatment.
490 – 3. To determine irregularities of the occlusion that require correction and to reveal irregularities that will be a factor in determining the type of appliance to be constructed.
490 – 4. The procedures to be accomplished during the appointment and the laboratory time required between appointments.
490 – 5. By closely coordinating the patient scheduling with the dental officer and the dental laboratory.

491 – 1. A full denture is an appliance that replaces the full number of teeth in the arch. It is made from acrylic with porcelain or acrylic teeth.
491 – 2. The preliminary impressions are taken and the AF Form 994 is initiated.
491 – 3. Soften the compound, place it in the tray after the tray is positioned in the mouth, and cool it with water until the compound hardens.
491 – 4. To prevent materials from sticking to his or her skin.
491 – 5. To take the final.
491 – 6. One of the "wash" types.
491 – 7. Build the baseplates and occlusal rims.
491 – 8. To record interocclusal relationships and to select the artificial teeth.
491 – 9. Mount the casts on an articulator, set the teeth into the wax occlusal rim, and trim the wax so that it resembles a denture.
491 – 10. To try the waxed-up denture in the patient's mouth and make any necessary adjustments.
491 – 11. To insert the denture.

492 – 1. It is used as an appliance to replace less than a full number of teeth in one arch. It may be made from gold, chrome-cobalt, or acrylic, with procelain or acrylic teeth.
492 – 2. The rest of the preparations are cut into the abutment teeth and the impressions are taken.
492 – 3. A rimlock tray.
492 – 4. To prevent distortion caused when the impression material dries out.
492 – 5. Makes the occlusal rims and sends the master casts to the ADL to have the metal framework made.
492 – 6. The occlusal and centric relationships are recorded and the tooth shade and mold are selected.
492 – 7. To insert the appliance.

493 – 1. (1) c.
(2) g.
(3) a.
(4) f.
(5) j.
(6) i.
(7) d.
(8) h.
(9) e.
(10) b.
493 – 2. The tooth is prepared, then the dental officer constructs a wax pattern of the crown or inlay in the mouth. The wax pattern is then sent to the laboratory for investing or casting.
493 – 3. The tooth is prepared and an impression is taken. The impression is then sent to the dental laboratory.
493 – 4. The impression is poured to make a die and a wax pattern is built on the die.
493 – 5. The wax pattern is placed in a casting ring and invested in heat-resisting gypsum. The casting ring is heated in an oven to eliminate the wax. Molten metal is then cast into the void left from the wax, thereby forming the crown or inlay.
493 – 6. The crown or inlay is cemented into place.
493 – 7. They replace all or part of the coronal tooth structures.

494 – 1. It is an appliance permanently fixed to abutments with inlays or crowns which cannot be removed by the patient. It is usually made from gold and has porcelain or acrylic facings.
494 – 2. A pontic is an artificial tooth suspended from one or more abutments of a fixed partial denture.
494 – 3. A cantilever bridge.
494 – 4. An impression is taken of the entire arch with the castings in place. The impression is poured up in a special soldering investment. The pontic is then stabilized in its proper position with soldering investment and attached to the castings with gold solder.

495 – 1. F. Obturators are appliances designed to close the unnatural opening between the mouth and nasal cavity.
495 – 2. T.
495 – 3. F. Normally, impressions of both arches are made.
495 – 4. T.
495 – 5. T.
495 – 6. F. A temporary made of acrylic resin is usually made first.

496 – 1. Those that require impressions and those that do not.
496 – 2. The shrinkage and changes which the tissues that support the denture undergo.
496 – 3. The original denture.
496 – 4. In the dental laboratory.

497 – 1. Most impressions tend to distort because of dehydration or room temperature variations.
497 – 2. Plaster of Paris, hydrocal, or minor variations of these.
497 – 3. T.
497 – 4. T.
497 – 5. F. Avoid whipping the mix, which will cause the final product to have excessive air bubbles.
497 – 6. F. Always add the powder to the water.
497 – 7. T.
497 – 8. F. Never add water to a mix that is too thick, because this interferes with the setting mechanism.
497 – 9. The two-step method.
497 – 10. The boxed method.
497 – 11. The upright method.
497 – 12. Wet paper, asbestos, wax, or any other suitable material.
497 – 13. The vibrator.
497 – 14. The model trimmer.
497 – 15. 3/8 to 1/2 inch.
497 – 16. To the outermost edge of the peripheral roll.
497 – 17. One way is to follow the contour completely around the peripheral boundary. The other way is to trim the outer border in four straight lines. These lines run from the third molar area to the cuspid and from the cuspid to the midline on either side of the cast. The posterior border should be trimmed so that the highest point does not exceed the occlusal plane level.

498 – 1. Usually on patients needing full dentures to take the final (detailed) impression.
498 – 2. Self-curing acrylic resin.
498 – 3. The dough and the sprinkle method. In both methods the cast is first coated with a separating material. Using the dough method, you mix the acrylic powder and liquid until it reaches the dough stage, mold it with your hands into a wafer, and adapt it to the cast. Use some of the material to form a handle. Using the sprinkle method, you sprinkle powder over the cast, saturate it with liquid, and repeat this procedure until you reach the desired thickness.

498 – 4. Failure to block out undercuts will result in a damaged cast or tray when you attempt to remove the hardened tray.
498 – 5. By filling them in with baseplate wax or modeling clay.
498 – 6. By adapting a sheet of baseplate wax over the cast before you adapt the acrylic.
498 – 7. Perforation can help minimize tissue displacement and provide retention of the impression material to the tray.

499 – 1. The patient's vertical biting depth, occlusal plane, midline, contour, and fullness of the lips and cheeks, etc.
499 – 2. A baseplate and bite rim.
499 – 3. The slurry water acts as a separating media.

499 – 4. Center the baseplate on the cast, then use an alcohol torch or Bunsen burner to soften the baseplate. Using your fingers you then adapt the material to the cast. Trim off the excess material and smooth any rough edges.

499 – 5. Paper clips.

499 – 6. Soak the cast in slurry water. Dip the cast into melted baseplate wax and quickly readapt the baseplate to the cast.

499 – 7. Baseplate wax.

499 – 8. More baseplate wax.

499 – 9. Heat and roll a sheet of baseplate wax into a cylinder shape. Shape it like a horseshoe, adapt it to the baseplate and shape with a compound knife and wax spatula.

500 – 1. (1) c.
(2) b.
(3) a.

501 – 1. Prosthetic.

501 – 2. Making impressions, pouring casts, trimming casts, and assisting with the cementation of the appliances.

501 – 3. Used for band forming, band removal, ligature tying, wire bending, safety wire cutting, etc.

501 – 4. The cement will not hold as well if there is any debris on the teeth.

502 – 1. (1) Separation from their parents.
(2) Unknown settings such as the dental operatory.
(3) Strange people.
(4) Unknown situations.

502 – 2. Overindulgent, overanxious, domineering, etc.

502 – 3. The pulp of a primary tooth is generally much closer to the surface.

502 – 4. Pulpotomy.

502 – 5. To replace missing teeth until either the permanent tooth errupts or the patient reaches an age where they are better able to tolerate complicated prosthetic treatment.

502 – 6. (1) Aids in the preservation of primary teeth. Primary teeth preserve the space for and provide a pathway of erruption for the permanent teeth.
(2) Proper preventive training can prepare an individual for a much more dentally trouble-free life.

502 – 7. Treatment of injuries.

503 – 1. The swallowing or aspiration of debris in the mouth.

503 – 2. You may be asked to remove the excess cement.

503 – 3. (1) If a patient must eat, a liquid, since it requires no chewing, is best because of numbness from anesethic.
(2) No eating or drinking following fluoride application.

503 – 4. A positive approach.

STOP-
1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

98150 03 25

ADMINISTRATIVE FUNCTIONS AND CHAIRSIDE ASSISTING

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (400) Keeping a patient informed in case the appointment is delayed beyond its scheduled time helps to satisfy which psychological need of the patient?

   a. Security.
   b. Recognition.
   c. Affection.
   d. Achievement.

2. (401) Which choice identifies a desirable telephone mannerism for a dental receptionist?

   a. Avoid letting your voice show a smile.
   b. Offer complete help on the telephone, including the diagnosis of the patient's condition.
   c. Be extremely firm and businesslike in all situations.
   d. Speak as a representative of the dental clinic and reflect an eagerness to help.

3. (402) What are the types of dental attendance?

   a. Scheduled and common.
   b. Limited and routine.
   c. General and emergency.
   d. Active duty and dependent.

4. (403) By using both the front and back of AF Form 1223a, Dental Appointment Register, you can schedule appointments for

   a. eight operators for 1 day or one operator for 8 days.
   b. six operators for 1 day or one operator for 6 days.
   c. four operators for 1 day or one operator for 4 days.
   d. two operators for 1 day or one operator for 2 days.

5. (404) One reason for conducting a periodic dental examination is to

   a. check proper custody of the dental health record.
   b. accomplish an annual patient health history.
   c. accomplish a new dental health record.
   d. check accuracy of previous charting.

6. (405) Which of the following examinations consists of a mouth-mirror and explorer examination using either adequate natural or artificial illumination and is a generalized examination of all hard and soft tissues?

   a. Type 2.
   b. Type 3.
   c. Type 4.
   d. Type 5.

7. (406) What dental classification applies to a patient who has minor or incipient caries that do *not* endanger the pulp?

   a. A.
   b. B.
   c. C.
   d. Other.

8. (407) Select the primary custodian of dental treatment records.

   a. The dental superintendent.
   b. The clinic receptionist.
   c. The appointment clerk.
   d. The base dental surgeon.

9. (408) Which of the following is a *permanent* part of a dental record?

   a. SF 513, Medical Record-Consultation Sheet.
   b. AF Form 935, Periodontal Diagnosis and Treatment Plan.
   c. AF Form 64, Record of Dental Attendance.
   d. AF Form 696, Dental Patient Medical History, 2 years old with negative entries.

10. (409) When available, you should use cardboard mounts for which of the following types of radiographs?

a. Periopical.
b. Extraoral.
c. Occlusal.
d. Bitewing.

11. (410) How would a maxillary first bicuspid with facial-lingual surfaces be abbreviated in a dental record?

a. #4-LB.
b. #5-FL.
c. #13-FL.
d. #14-LB.

12. (410) The correct abbreviation for a defective, fixed, partial denture is

a. def fxd pr dtr.
b. def fx ptr dtr.
c. def fx pr dtr.
d. def fx pr dr.

13. (411) To correctly chart an apicoectomy, you would

a. outline the defective area and block in solidly.
b. trace a jagged fracture line in the relative position on the root.
c. draw a small triangle at the approximate line of the root amputation.
d. circle the missing portion of the root and place a small "X" in the circle.

14. (412) If the last two digits of a patient's SSAN fall within 80 to 89, which one of the following color coded AF Form 2100-series treatment folders would be used?

a. Red.
b. Pink.
c. Brown.
d. Orange.

15. (412) What relationship prefix is used to denote a patient as the second oldest child of an active duty master sergeant who has four children?

a. 42.
b. 24.
c. 02.
d. 00.

16. (413) For whom is AF Form 1942, Clinical Index, prepared?

a. All active duty Air Force personnel.
b. Active duty personnel of branches of the military other than Air Force.
c. Only dependents of active duty military.
d. Nonmilitary and retired military personnel.

17. (414) Where should records that become separated from active duty personnel be sent?

a. Their current duty station.
b. The gaining CBPO.
c. Records repository in St Louis MO.
d. AFMPC, Randolph AFB TX.

18. (415) What action is taken if an individual refuses to sign DD Form 2005, Privacy Act Statement--Health Care Records?

a. Notify the dental surgeon.
b. Note this fact on the Health Record.
c. Notify the dental superintendent.
d. Note this fact on the form.

19. (416) What are the entries in Section I, Dental Examination, of the SF 603 (Health Record-Dental) intended to reflect?

a. The patient's general health data.
b. The patient's dental health history prior to entry into the service.
c. The patient's dental condition upon entry into the service.
d. The restorations completed during the patient's military service.

20. (416) How are entries made in Section II, subsection 8 of the SF 603, Health Record-Dental?

a. In blue-black ink.
b. In pencil.
c. Typewritten.
d. In ink, capital letters.

21. (417) When, if ever, should *negative* dental patient medical histories (AF Form 696s) be destroyed?

a. Never.
b. After one year.
c. After 2 years.
d. As soon as a new history is completed.

22. (418) Which of the following is *not* a function of AF Form 644, Record of Dental Attendance?

a. To update the base-level personnel system.
b. To keep account of broken dental appointments.
c. For compiling statistical data for the automated reports.
d. To provide information to be transposed to the dental health record.

23. (419) How long is the SF 513, which is returned by the consultant as part of the patient's dental record, retained?

a. Permanently.
b. Two years.
c. It does not become a part of the dental record at all.
d. Until it is of no further value.

24. (420) What is the basic purpose of AF Form 935?

a. To record patient's general health data.
b. For use by medical officer to request dental consultation.
c. For use when the dental treatment record is *not* available.
d. To provide a basic periodontal examination, diagnosis, and treatment planning record for periodontal therapy.

25. (421) On which of the following laboratory request forms is it essential to include a brief pertinent dental history?

a. SF 515, Tissue Examination.
b. SF 549, Hematoloy.
c. SF 550, Urinalysis.
d. SF 551, Serology.

26. (422) Which form serves as a record of inspection, verification, and accounting for precious metals?

a. AF Form 520.
b. AF Form 579.
c. AF Form 781.
d. AF Form 994.

27. (422) Each clinic must maintain control of security item type drugs through the use of

a. AF Form 520.
b. AF Form 579.
c. AF Form 781.
d. AF Form 994.

28. (423) Under what conditions would the SF 521 be used as a dental health record?

a. When the patient is TDY.
b. If the patient is on inpatient status.
c. If emergency treatment is *not* available.
d. When the dental treatment record is *not* available.

29. (424) Which part of the Dental Services and Activities Report 7104 summarizes the professional capabilities, availability, and management of dental personnel resources?

a. Part 1.
b. Part 2.
c. Part 4.
d. Part 5.

30. (425) The budget sets the final pattern for the financial operation of the clinic for

a. a quarter.
b. half a year.
c. an entire year.
d. a five year period.

31. (426) The dental service history is incorporated with that of

a. the medical unit.
b. the wing.
c. the base.
d. the major command.

32. (427) Select the medical objective(s) supported by dental clinics in the hypertension screening program.

a. Elimination of hypertension in active duty military.
b. Diagnosis and prescription of medication for hypertension.
c. Cure of hypertension prior to any definitive dental treatment.
d. Early detection, evaluation, and treatment of hypertension.

33. (428) Which regulation lists departmental publications in numerical order according to subject, series, type, and status of the publication?

a. AFR 0-2.
b. AFR 0-4.
c. AFR 0-5.
d. AFR 0-9.

34. (429) Which digits of the 13-digit national stock number tell what the item is?

a. First two.
b. First seven.
c. Last two.
d. Last seven.

35. (429) Most dental supply items are in which numerical group in the Federal Supply Catalog?

a. 60.
b. 63.
c. 65.
d. 68.

36. (430) Which of the following catalogs contains items in general use throughout the Federal Government, ranging from mops to file cabinets?

a. GSA Catalog.
b. USAF Supply Catalog.
c. Federal Supply Catalog.
d. Interservice Supply Catalog.

37. (431) What level of consumable items is normally authorized?

a. One-week supply.
b. Two-week supply.
c. Three-week supply.
d. Four-week supply.

38. (432) Which one of the following *not* a purpose of the supply inventory?

a. To reveal whether items are on hand and accountable.
b. To reveal whether items and quantities on hand are adequate.
c. To reveal and replace all unusable items.
d. To reveal whether established levels are realistic.

39. (432) Dental silver-bearing scrap materials are accumulated and turned in to

a. medical supply.
b. base supply.
c. redistribution and marketing activities.
d. local recovery centers.

40. (433) Pecuniary liability may be shared in any particular case by persons having what type of responsibility?

a. Command.
b. Supervisory.
c. Custodial.
d. All of the above.

41. (434) If pecuniary liability is involved and the amount involved is more than $500, what form is used?

a. AF Form 198, Report of Survey of AF Property.
b. DD Form 114, Military Pay Orders.
c. DD Form 362, Statement of Charges.
d. DD Form 1131, Cash Collection Voucher.

42. (435) In most instances involving dental equipment, who is notified of equipment breakdown?

a. Medical equipment maintenance section.
b. Civilian firm which manufactured the equipment.
c. Biomedical equipment technician from your support base.
d. Nearest base where equipment repair facilities are available.

43. (436) Name the working part of a condensing instrument.

a. Blade.
b. Shank.
c. Head.
d. Nib.

44. (436) The identification number of a single-ended dental instrument is usually found on the

a. inner portion of the instrument's shank.
b. portion of the handle nearest the working end.
c. portion of the handle farthest from the working end.
d. in the middle of the instrument halfway between the shank and the end of the instrument.

45. (437) Which instrument is designed to detect small cavities and fractured tooth enamel?

a. Explorer.
b. Vitalometer.
c. Transilluminator.
d. Periodontal probe.

46. (438) Which shape of bur is designed to gain entrance into the tooth and remove decayed tooth substance?

a. Round.
b. Inverted cone.
c. Tapered fissure.
d. Straight fissure.

47. (439) Select the proper term for an abrasive disk that has one side covered with abrasives and the other side free of abrasives.

a. Slick-surface disk.
b. Safe-sided disk.
c. One-surface disk.
d. Pain-sided disk.

48. (440) In which section of the dental clinic is a rubber dam routinely used?

a. Periodontics.
b. Oral surgery.
c. Prosthodontics.
d. Endodontics.

49. (441) Identify the restorative chisels which have slightly curved shanks.

a. Biangle.
b. Stright.
c. Delta-shaped.
d. Wedelstaedt.

50. (441) The instruments which carry the identification numbers 29 and 34 are

a. hoes.
b. chisels.
c. hatchets.
d. spoon excavators.

51. (442) Which item is used to force a matrix band tightly against irregular tooth surfaces to eliminate space that could result in an overhanging restoration?

a. Wedge.
b. Crown former.
c. Cotton roll.
d. Matrix retainer.

52. (442) Which type of strip matrix material is used in conjunction with silicate or resin filling materials?

a. Copper.
b. Plastic.
c. Copper nickel.
d. Stainless steel.

53. (443) Instruments used to pack amalgam into cavity preparations are called

a. spatulas.
b. carriers.
c. condensers.
d. burnishers.

54. (444) Which spatula is suitable for mixing small quantities of cement?

a. #31.
b. #142.
c. #313.
d. #324.

55. (445) What tooth-extracting forceps is particularly effective for removing maxillary cuspids?

a. #1.
b. #53L.
c. #88L
d. #217.

56. (445) What teeth are the tooth-extracting forceps #88L and #88R designed to remove?

a. Mandibular bicuspids.
b. Mandibular molars.
c. Maxillary molars.
d. Maxillary cuspids.

57. (446) Which forceps used in oral surgery have a graduated, notched-locking device located near the ends of the handles?

a. Tissue.
b. Dressing.
c. Instrument.
d. Needle-holder.

58. (447) If the oral surgeon called for a Seldin #11, what instrument would you pass to him or her?

a. Bone file.
b. Currette.
c. Crossbar elevator.
d. Periosteal elevator.

59. (447) Surgical scissors with a saw-toothed cutting edge are designed to cut

a. gauze sponges.
b. alveolar bone.
c. suture material.
d. soft oral tissues.

60. (448) Which surgical elevator would the oral surgeon use to lift or elevate a fractured zygoma?

a. Root.
b. Malar.
c. Crossbar.
d. Periosteal.

61. (449) The shape of *most* suture needles used by oral surgeons is

a. hooked.
b. circular.
c. straight.
d. semicircular.

62. (450) Select the scaler(s) designed for primary use in anterior areas on the facial, lingual, and interproximal surfaces.

a. Gracey #1.
b. McCall #13-14.
c. U-15-33.
d. Ultrasonic scaler.

63. (451) Which of the following currettes is designed for scaling bicuspid teeth?

a. Gracey #3-4.
b. Gracey #11-12.
c. McCall #13-14.
d. McCall #17-18.

64. (451) The instruments used to perforate gingival tissue and thereby provide a reference line for the excision of excess gingival tissue are periodontal

a. probes.
b. knives.
c. curettes.
d. pocket-marking forceps.

65. (452) Which sequence of root canal instruments indicates the order in which they would normally be used?

a. File, reamer, broach, plugger.
b. Broach, plugger, reamer, file.
c. Reamer, broach, file, plugger.
d. Broach, reamer, file, plugger.

66. (453) Which type of impression tray should you select for the use of hydrocolloid impression materials?

a. Stainless steel.
b. Rimlocking.
c. Aluminum.
d. Sectional.

67. (453) The Beebee curved and Quimby curved are examples of

a. fabric scissors.
b. surgical scissors.
c. periodontic scissors.
d. collar and crown scissors.

68. (454) Instruments should be drawn over the sharpening stone with a

a. short, light stroke.
b. short, firm stroke.
c. long, light stroke.
d. long, firm stroke.

69. (455) With regard to dental equipment, the key to good housekeeping is to

a. clean it only when it appears dirty.
b. always wait to be directed to perform the cleaning.
c. make a habit of cleaning at prescribed intervals.
d. thoroughly clean any equipment on which micro-organisms are visible.

70. (456) Prior to dismantling lighting fixtures for their periodic cleaning, you should

a. disconnect and remove the light switch.
b. ground the light switch with a safety wire.
c. place the switch in the OFF position and make provisions so it cannot inadvertently be turn ON.
d. turn the fuse box switch connected to the electrical switch to the OFF position and lock the door of the fuse box.

71. (457) Maintaining lawns and hedges around the dental clinic is the responsibility of

a. base civil engineering.
b. all dental personnel.
c. the civilian custodian.
d. the base civilian contractor.

72. (458) The maintenance performed by a medical equipment repair center (MERC) functioning on a geographic basis is

a. area maintenance.
b. field maintenance.
c. preventive maintenance.
d. organizational maintenance.

73. (459) Probably the best approach to preventive maintenance of dental equipment consists of a visual inspection followed by an operational check at the

a. close of each duty day.
b. beginning of each duty day.
c. time of inspection by a medical equipment repairer.
d. time of the installation of the new equipment and at monthly intervals.

74. (459) What air system problem encountered with dental operating units is correctable by draining the air tank and purging the air lines daily?

a. Air is too dry.
b. Air pressure is too low.
c. Air pressure is too high.
d. Air contains excessive moisture.

75. (460) To expel air from the hydraulic system of a dental operating chair, the first step is to

a. remove the electric motor, the seat cushion, and the air vent screw.
b. remove the hand lever, the seat cushion, and the air vent screw.
c. lower the chair to its lowest position, remove the seat cushion, and locate the air vent screw.
d. raise the chair to its highest position, remove the seat cover, and remove the air vent screw.

76. (461) What system is the main power source for ultra-speed handpieces?

a. Air.
b. Water.
c. Electrical.
d. Hydraulic.

77. (462) Conventional-speed, contra-angle handpieces should be lubricated after

a. each use.
b. 5 hours of use.
c. 10 hours of use.
d. 20 hours of use.

78. (463) Which one practice listed below should be *avoided* in the maintenance of diamond-coated rotary instruments because it causes deterioration of the bonding material?

a. Soaking the instrument in soapy water and then scrubbing debris away with a bristle brush.
b. Using an ink eraser for cleaning debris from the instruments' grit.
c. Soaking the instrument in pure mercury as a part of amalgam removal.
d. Boiling and autoclaving the instruments.

79. (464) In general, the dental operating light joints should be lubricated

a. weekly.
b. monthly.
c. every six months.
d. yearly.

80. (465) The high-speed oral evacuator works on the principle of

a. low pressure and high volume.
b. high pressure and low volume.
c. low pressure and low volume.
d. high pressure and high volume.

81. (466) What is a normal result of lubricating the single shaft of dental operating mobile stools?

a. The stool base will malfunction.
b. The caster bearing will deteriorate.
c. The shaft will attract dirt and clog the sliding mechanism.
d. The locking mechanism will not hold in its adjusted position.

82. (467) Which of the following should be used in autoclaves to produce steam?

a. Sterile water.
b. Distilled water.
c. Normal saline solution.
d. Tap water.

83. (468) In order to remove objects that have fallen through the case of an amalgamator, you should

a. remove the case and gently shake it.
b. turn the unit on its side and vigorously shake it.
c. unplug the unit, remove the case, and then vigorously shake the unit.
d. unplug the unit, turn it upside down, and gently rotate it back and forth.

84. (469) Your conduct as a dental assistant should be guided by what principle?

a. The orders of the dental surgeon.
b. The Hippocratic oath.
c. The spirit of the Golden Rule.
d. The uniform code of military justice.

85. (469) Which of the following actions could result in legal implications?

a. Seating the patient in an uncomfortable position.
b. Discussion the patient's health history with the dentist.
c. Telling the patient what treatment the dental officer is going to perform.
d. Underexposed radiographs.

86. (470) When you first seat a patient, what tooth plane should be parallel to the floor?

a. Occlusal.
b. Mesial.
c. Distal.
d. Facial.

87. (471) What type of drape is used when contamination is a prime consideration?

a. Routine.
b. Postoperative.
c. Surgical.
d. Disinfecting.

88. (471) When you have properly draped a patient for dental surgery, everything in the operative field will be covered except the nose, mouth, and

a. eyes.
b. ears.
c. chin.
d. neck.

89. (472) What date should be placed on setup trays or packs?

a. One month from the date the instruments were packed.
b. One month from the date the instruments were sterilized.
c. Three months from the date the instruments were sterilized.
d. The date that the contents will no longer be considered sterile.

90. (473) Which of the following anesthetics does *not* contain a vasoconstrictor?

a. Mepivacane hydrochloride 3 percent.
b. Mepivacane hydrochloride 2 percent.
c. Lidocaine hydrochloride 2 percent, 1:100,000.
d. Lidocaine hydrochloride 3 percent, 1:50,000.

91. (473) When should you bend and break or cut the needles to prevent further use?

a. As soon as the doctor gives the injection.
b. While the patient is still in the chair so he or she knows the needle won't be used again.
c. After the patient has been dismissed.
d. Whenever you have time during the procedure.

92. (474) How should you position the working end of instruments that you pass to the dentist?

a. The working end pointed toward the treatment area.
b. The working end pointed toward the dentist.
c. However is most comfortable for you.
d. It doesn't matter since the dentist will change it to suit his or her style.

93. (475) What type of pressure should you apply to the tissue you are retracting?

a. Very light.
b. Light.
c. Very firm.
d. Firm enough to prevent slippage.

94. (476) Which of the following is used for irrigation during restorative procedures?

a. Gomco aspirator.
b. Oral evacuator.
c. Bulb-type or Luer syringe.
d. The unit's water syringe or spray system.

95. (477) Culture media is used to

a. promote micro-organism growth.
b. destroy micro-organisms.
c. report on microscopic findings.
d. separate one micro-organism from another.

96. (478) In most cases, when can you complete your administrative tasks?

a. Before the patient enters the DTR.
b. During breaks in your chairside assisting.
c. After the procedures are completed but before the patient leaves the DTR.
d. After the procedures are completed and the patient has left the DTR.

97. (479) One of the more important elements in maintaining supply levels in dental treatment rooms is that of

a. insuring you have an excess of materials on hand so you don't run out during a patient's treatment.
b. hoarding supplies so you are insured of all the supplies you need.
c. conducting thorough and frequent inventories.
d. only ordering the amount of supplies your storage cabinets can hold.

98. (480) In four-handed dentistry, the dentist and assistant should operate from what position?

a. Both standing.
b. Both seated.
c. The dentist supine and the assistant seated.
d. The dentist seated and the assistant standing.

99. (481) All of the following are desirable characteristics of the four-handed dental unit *except*

a. has a compact design.
b. is equipped with a cuspidor.
c. has a multipurpose syringe.
d. has conveniently positioned hose-attached instruments.

100. (482) As related to the face of a clock, in what zones should the dentist's and assistant's stools be positioned when performing four-handed dentistry procedures?

a. The dentist is in the 8 to 11-o'clock position and the assistant is in the 2-to-5-o'clock position.
b. The dentist is in the 11-to-1-o'clock position and the assistant is in the 4-to-6-o'clock position.
c. The assistant is in the 8-to-11-o'clock position and the dentist is in the 2-to-11-o'clock position.
d. The assistant is in the 11-to-1-o'clock position and the dentist is in the 4-to-6-o'clock position.

101. (483) The proper use of four-handed dentistry procedures improves

a. the administration of patient records.
b. the quality of treatment.
c. the quantity of treatment.
d. both quality and quantity of treatment.

102. (484) When assisting in the examination section, most of your time is spent

a. assisting in emergency procedures.
b. completing forms.
c. handling phone calls.
d. exposing radiographs.

103. (485) Why should you replace the protective covering on the anesthetic needle after the injection has been completed?

a. You should destroy the needle right away.
b. To insure safety, and a second injection may be recovered.
c. So the patient can't see the needle.
d. To keep the needle sterile.

104. (486) The removal of the sharp bony edges that result from a multiple extraction is called

a. an alveolectomy.
b. a frenotomy.
c. a surgical removal.
d. a tori removal.

105. (487) When should you drape a patient for oral surgery procedures?

a. Before you don your rubber gloves.
b. After you don your rubber gloves.
c. Before the doctor dons his or her rubber gloves.
d. After the doctor dons his or her rubber gloves.

106. (488) What is the most common procedure performed in endodontics?

a. Pulpotomy.
b. Pulpectomy.
c. Apicoectomy.
d. Apicotomy.

107. (489) The primary purpose of periodontal treatment is

a. equilibration.
b. gingivectomy.
c. osseous contouring.
d. eradication of periodontal pockets.

108. (489) Which of the following periodontal procedures is the adjusting of the occlusal contact areas between the upper and lower teeth so that each carries its equal share of the occlusal load?

a. Equilibration.
b. Osseous contouring.
c. Root planing.
d. Curettage.

109. (490) Most prosthodontic cases require a series of appointments. Whose duty is it usually to schedule these appointments?

a. The prosthodontist.
b. The prosthodontist's assistant.
c. The central appointment personnel.
d. The patient's duty section, because they know the work schedule.

110. (491) When constructing a complete or full denture, the second appointment is used to

a. take preliminary impressions.
b. obtain interocclusal relationship.
c. obtain the final impression.
d. try the waxed-up trial dentures in the patient's mouth.

111. (492) The purpose of the third appointment when a patient is having a removable partial denture made is to

a. prepare rest preparations in the teeth.
b. take impressions of the hard and soft structures of both arches.
c. establish and record the relationship between the maxillary and mandibular arches.
d. insert the completed removable partial denture.

112. (493) A gold crown, the facial surface of which has been covered with a porcelain or acrylic shell, is a

a. veneered metal crown.
b. thimble or coping crown.
c. complete veneer crown.
d. partial crown.

113. (494) A fixed partial denture that only has an abutment on one side is a

a. bilevel bridge.
b. thimble or coping bridge.
c. unilateral bridge.
d. cantilever bridge.

114. (495) An appliance designed to close the unnatural opening between the mouth and nasal cavity of patients having a cleft palate is

a. a maxillary cantilever bridge.
b. a splint.
c. an obturator.
d. a full or complete maxillary denture.

115. (496) Existing appliances must be serviced. Which of the following is *not* presented by the text as a type of servicing?

a. Relining.
b. Refinishing.
c. Repairing.
d. Rebasing.

116. (497) To assure a good cast mix, you should

a. whip the mix.
b. always add the powder to the water.
c. partially spatulate the initial mix.
d. add a little water if the mix gets too thick.

117. (497) How close to the teeth should the outer boundary of the cast be trimmed?

a. To the outermost edge of the peripheral roll.
b. To the innermost edge of the peripheral roll.
c. To the outermost edge of the posterior teeth.
d. To the innermost edge of the posterior teeth.

118. (498) If the cast you are going to use has deep undercuts, you may block them out by using

a. baseplate wax or modeling clay.
b. plaster of Paris.
c. acrylic resin.
d. boxing wax.

119. (499) Before you adapt the baseplate to the cast, immerse the cast in

a. hot water.
b. cold water.
c. slurry water.
d. distilled water.

120. (499) What is used as the bonding material for attaching the bite rim to the baseplate?

a. Paper clips.
b. More baseplate wax.
c. Acrylic resin.
d. Dental stone.

121. (500) Which type of orthodontic treatment may involve serial extraction, space maintenance, space regaining, and crossbite control?

a. Preventive.
b. Restorative.
c. Interceptive.
d. Corrective.

122. (501) Why should coronal polishing of the crowns of the teeth be accomplished prior to cementation of the band or of bonding the brackets?

a. So the dentist has a clear field of vision.
b. The cement will not hold as well if there is debris on the teeth.
c. The cement bonds too quickly to any debris left on the teeth.
d. The bands are usually left on the teeth for extended periods of time and it's the only chance to clean the teeth until the bands are removed.

123. (502) What type of endodontic treatment is usually performed on children in the pedodontic section?

- a. Apicoectomy.
- b. Apicotomy.
- c. Pulpotomy.
- d. Pulpectomy.

124. (503) When working with stainless steel crowns, if the crown selected is not the proper size, it

- a. is placed back in the box and another is selected.
- b. is thrown away.
- c. must be sterilized before returning it to the set.
- d. must be disinfected before returning it to the set.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012 and EO 9397. **PRINCIPAL PURPOSES:** To provide student assistance as requested by individual students. **ROUTINE USES:** This form is shipped with ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. **DISCLOSURE:** Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance to the student.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: *(Mail to ECI, Gunter AFS AL 36118)*

1. THIS REQUEST CONCERNS COURSE (1 - 6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER
5. SOCIAL SECURITY NUMBER (7 - 15)	6. GRADE/RANK	7. NAME *(First initial, second initial, last name)* (17) (18) (19-32)	

8. ADDRESS *(OJT Enrollees -- Address of unit training office with zip code. All others -- current mailing address with zip code.)* (33-53) (54-75)

9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE

10. TEST CONTROL OFFICE ZIP CODE/SHRED (33 - 39)

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(Place an 'X' through number in box to left of service requested)

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2	Request Test Control Office change as indicated in Section I.
3	Request name change/correction (Provide Old or Incorrect data)
4	Request Grade/Rank change/correction.
5	Correct SSAN. (List incorrect SSAN here) (Correct SSAN should be shown in Section I)
6	Extend course completion date. (Justify in REMARKS)
7	Request enrollment cancellation.
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. (Specify in REMARKS) ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on ______________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 not yet received. Answer sheet(s) submitted ______________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on ______________ (date).
13	Previous inquiry (☐ ECI Fm 17, ☐ Ltr, ☐ Msg) sent to ECI on ______________ (date).
14	Give instructional assistance as requested on reverse.
15	Other (Explain fully in REMARKS)

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38 1	39 - 42	
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16		

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☐ Yes ☐ No

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DENTAL ASSISTANT SPECIALIST

(AFSC 98150)

Volume 4

Dental Radiology and Preventive Dentistry

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Preface

FROM THIS fourth volume of *CDC 98150, Dental Assistant Specialist*, you are provided with information which, if placed into practice, will improve your skills in several critical areas of your job. Today's Air Force dental assistants are expected to be able to function in any section of the dental clinic. Many of their job tasks involve direct patient contact. Be prepared to accept the role and the many duties expected of you as a member of the dental health care team. The knowledge you can gain from this volume, added to that gained from the other volumes, will enable you to be of greater service to your patients.

In the first chapter, you will study dental radiology. This chapter will provide information on the principles of radiography, the long cone technique, film processing and mounting, and the evaluation of the radiographs. Chapter 2 details some extremely important data; it covers the clinical procedures you may perform in preventive dentistry. Areas covered are the USAF Preventive Dentistry Program, oral prophylaxis procedures, fabricating impressions, casts and mouthguards, oral health education, and preventive dentistry counseling. Chapter 3 provides information on the nutritional needs of your patient. The last chapter focuses on the recognition and treatment of medical emergencies that can arise in the dental treatment room.

This volume is valued at 42 hours (14 points).

Material in this volume is technically accurate, adequate, and current as of 15 January 1984.

Contents

Page

Preface iii

Chapter

1 Dental Radiology 1

2 Preventive Dentistry 30

3 Nutrition 68

4 Emergency Procedures 100

Bibliography 112

Answers for Exercises 113

Dental Radiology

THE X-RAY was discovered by Wilhelm Konrad Roentgen in November 1895 in Wurzburg, Bavaria. Dr. Edmund Kells first advocated the use of X-rays in the field of dentistry in 1896. Since then the use of X-rays in dentistry has gradually increased until an X-ray examination now plays a prominent part in most diagnoses of dental disorders. This, naturally, demands much of you in the field of radiography.

1-1. Radiology Principles

Quality radiographs must be produced consistently for the dental officer to have the best diagnostic film possible. You must have a thorough understanding of the principles of radiology to perform the various X-ray exposure examination techniques accurately and carefully. Additionally, since X-radiation can be dangerous, it is important that you produce a good diagnostic radiograph each time to avoid exposing the patient unnecessarily.

600. State various ways in which radiographs are employed in the practice of dentistry.

Use of Dental Radiographs. Radiographs play an important role in diagnosing dental ailments. The radiograph allows the dental officer to view areas of the teeth and the surrounding structure that cannot be seen in a mouth mirror explorer examination. Through the use of radiographs the dental officer can both diagnose caries and determine how far they have progressed. Cysts, abscesses, and impacted teeth can also be identified by using radiographs. Periodontal disease involving bone loss can be seen, and the progression of this disease can be closely followed. Radiographs also are used as a preoperative or postoperative record.

In most treatment areas, radiographs are used as a treatment aid. For instance, in the endodontic section the dentist often requests radiographs to determine if the root canal has been reamed or filed to the proper length. Additionally, the dental officer normally requests a postoperative radiograph to assure that the root canal has been properly filled. In oral surgery, radiographs are sometimes used to indicate the location of root tips that have fractured off during an extraction procedure. They also may be used to verify the complete removal of such root tips.

Exercises (600):

1. How do X-rays assist the dental officer in examining a patient's teeth?

2. How may radiographs and a dental officer in cases involving periodontal disease?

3. How may radiographs help the dental officer in the endodontic section as a treatment aid?

4. How may radiographs assist the oral surgeon as a treatment aid?

601. Given a list of statements that relate to the various properties of X-rays, match them to their appropriate property.

Properties of X-Rays. X-rays are short wavelengths of energy called photons. They travel with a wave motion similar to light or radio waves and at about the same speed (186,000 miles per second). The wavelength of an X-ray, however, is extremely short. It is only about one ten-thousandth that of visible light. In units that you can visualize more easily, the X-ray wavelength is approximately one-billionth of an inch. This extremely short wavelength enables X-rays to penetrate many substances. As an example, note that radio/television waves are a form of energy. This energy is capable of penetrating small amounts of solid matter—otherwise a television, for instance, with an indoor antenna could not receive transmissions from the station. Now, think of a form of energy which has wavelengths hundreds of millions of times shorter than those of radio waves. Imagine their penetrating ability! Let us discuss this penetrating effect and a few more of the functions of X-rays.

Penetrating effects. When X-rays pass through different substances, they penetrate in varying amounts and degrees, depending upon the wavelength of X-ray employed, the density of the substance being radiated, and the distance from the target to the substance. Scientists have found that the penetrating quality of X-ray will vary inversely with the wavelength—*the shorter the wavelength, the greater the degree of penetration*.

Photographic effects. When X-rays fall on a photographic film, the film chemicals are changed. When developed, the film appears in varying shades of gray, depending upon the amount of X-rays reaching it. Since X-rays travel in straight diverging lines, they can be used to record the density of various parts of the human body on a photographic film in the form of a shadow picture or a radiograph. These densities frequently vary due to pathosis; therefore, some pathological conditions can be detected with the aid of the radiograph.

Fluorescent effects. When X-rays fall on certain chemical crystals, such as calcium tungstate, the X-rays change to light waves of the visible spectrum, and the crystals fluoresce. This property is used in diagnostic work to give a rapid X-ray examination with the use of a photographic plate. The degree of fluorescence depends upon the number of X-rays striking the crystals. This is the principle used in the fluoroscopic apparatus.

Biological effects. Living cells are sometimes destroyed when subjected to X-radiation. This biological effect may be employed to destroy undesirable cell growths in the human body; for example, cancer. X-radiation treats certain skin diseases. Germ cells which can cause birth defects, also may be altered. This fact is the main concern in safety practices in using X-radiation.

Ionization effects. When X-rays pass through air or matter, ionization takes place. Ionization means that atoms are altered to become either negatively or positively charged. This property enables experts to measure the quantity of radiation produced by measuring the ionization (electrical charge) of the air through which the radiation passes.

Exercises (601):

1. Identify the properties of X-rays by matching the item in column B to the appropriate term in column A.

Column A

_____ (1) Speed of X-rays.
_____ (2) Fluorescent effect.
_____ (3) Biological effect.
_____ (4) Penetrating effect.
_____ (5) Photographic effect.

Column B

a. The special effect X-rays have on certain chemical crystals, such as calcium tungstate.
b. The property that enables experts to measure the quantity of radiation.
c. The degree of this effect is determined by the wavelength of the X-rays.
d. About the same as that of visible light.
e. The effect X-rays have on radiographic film.
f. The main concern for safety practices when using X-radiation.

602. Name the components of the X-ray tube, and state its operational characteristics.

Production of X-Rays. The production of X-rays occurs when high-speed electrons strike matter. In order to effectively produce X-rays, an electric current of high voltage must be applied and passed through the X-ray tube. The tube consists of two terminals, one positive and one negative. The cathode or negative terminal has two principal parts: (1) a tungsten filament, around which is placed a (2) molybdenum cup that focuses the cathode rays on the anode. The anode or positive terminal has three parts: the tungsten target upon which is located the focal spot where the cathode rays are directed; a copper head into which the tungsten target is set; and a copper stem that extends to the outer end of the anode arm. The copper head and stem serve to dissipate the heat created during X-ray production. These components are incased in a glass envelope, which forms the outer shell of the X-ray tube. (See fig. 1-1.) The tube itself is located inside the X-ray tube head. In addition to containing the X-ray tube, the tube head also contains an oil or a gas that serves as an insulator for the heat created during X-ray production.

Although the production of X-rays is as rapid a process as turning on a table lamp, there are two independent actions that occur. First, low-voltage current heats the tungsten filament of the cathode terminal to incandescence; as this occurs, a cloud of electrons forms around the tungsten filament. Next, high-potential (voltage) current is passed through the X-ray tube. This propels the electrons toward the tungsten target at a very high rate of speed.

During this transition from cathode to anode, kinetic energy is imparted to the electrons. Upon reaching the anode, the electrons are suddenly stopped as they impact against the tungsten target. During the stopping period, the electrons must give up the kinetic energy. The energy reappears or is converted to X-rays and heat. The bulk of the energy liberated at the anode is heat, with the remainder (about 1 percent) appearing as X-rays. The tungsten target is set in the copper head at an angle that directs the X-rays out the glass window of the X-ray tube.

To permit maximum acceleration of the electrons, the glass inclosure of the X-ray tube is under a high degree of vacuum. If a good vacuum is not present, unwanted atoms and electrons move around within the glass tubing. This will cause sparking; a gas discharge will take place inside the tube when current is passed through it and few, if any, X-rays will be produced.

The electron stream moving across the X-ray tube constitutes the tube current. This current, which is small in magnitude, is generally expressed in milliamperes (mA). One milliampere is 1/1000 ampere. Currents upward to 1,000 mA are used with modern X-ray tubes. The voltage across the anode and cathode is relatively high and is measured in kilovolts (kV). One kilovolt is 1,000 volts.

The X-ray wavelength of the emitted radiation varies from a certain minimum to very long. The wavelength is governed by the amount of voltage applied to the X-ray tube. X-rays produced by low voltage are of longer wavelength and have lower penetration. They are often referred to as soft radiation. X-rays produced by high voltage are of shorter wavelength and, therefore, have higher penetration power. These rays are referred to as hard radiation.

Exercises (602):

1. Name the two terminals of the X-ray tube.

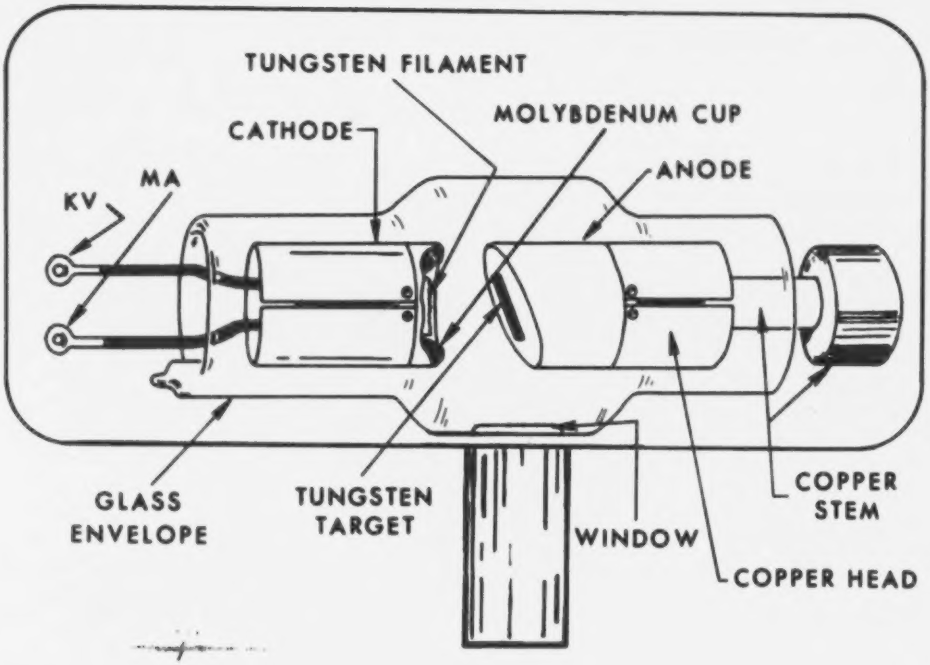


Figure 1-1. Components of the X-ray Tube.

2. Name the parts of the X-ray tube's positive terminal.

3. Name the parts of the X-ray tube's negative terminal.

4. When does a cloud of electrons form around the tungsten filament?

5. When are the electrons propelled toward the tungsten target at a high rate of speed?

6. What occurs as the electrons impact upon the tungsten target?

7. What condition inside the X-ray tube permits the maximum acceleration of electrons?

8. What current is measured in kilovolts?

9. Characterize the X-rays produced by high voltage.

603. Given a series of statements concerning the hazards and types of X-radiation, indicate which are true and which are false.

Hazards of Radiation. Adequately protecting the operator and the patient from the hazards of radiation is the most important consideration in the field of dental radiography. X-radiation is an invisible, odorless, and soundless form of energy that can inflict injury and can cause death to body tissues if the proper precautions are not observed. While we expeditiously remove ourselves from the path of a speeding locomotive, this self-protective instinct is not always observed with X-radiation. Since X-rays are not apparent inexperienced technicians have a tendency to overlook their potential hazards. This tendency is extremely dangerous, since X-rays possess the same potential hazard as that of a speeding locomotive. X-rays, if improperly used, can severely and irreparably damage vital body organs, cause genetic mutations, and result in the loss

440

of human life. Many of the early pioneers of radiography lost their lives learning the hazards of X-rays. Some modern-day radiologists and technicians have lost their limbs or their lives because they were irresponsible and did not bother to follow the safety practices. Carelessness and indifference on the part of the technician are the most common causes of overexposure to X-rays.

In the usual dental radiographic examination, the amount of radiation received by the patient is quite small and only a fraction of the harmful dose. The effects of radiation are, however, *cumulative*. This cumulative effect of X-rays can be extremely harmful. For example, there is a certain amount of cellular change in tissues and organs exposed to even safe quantities of radiation. As long as the body is functioning properly, most cells will regenerate themselves and become normal again. This regeneration does, however, take time; and if another dose of radiation is applied shortly after the first dose, more cellular changes (cumulative) will occur. If this additional cellular change is great enough to impair the function of the organ or tissue, repair or regeneration may not be possible. Though the cumulative effects present a danger to the patient, they probably present a greater danger to technicians because they spend numerous days in the exposure room. It is always wise, however, to question the patients and determine if they have recently been exposed to any type of radiation near the head and neck area. If numerous exposures have been made within the preceding 30-day period, it would be best to consult the dental officer before proceeding with any further dental X-ray exposures. For you to understand the need for proper safeguards against radiation, it is necessary that you understand the types of radiation produced by the X-ray equipment and the factors that influence the dose. The types of radiation produced during a radiographic examination are as follows:

a. Primary radiation. This radiation is the useful beam; it comes directly from the focal spot on the anode target of the X-ray tube.

b. Indirect radiation. This radiation comes from parts of the X-ray machine other than the focal spot. It may come from the tube housing and head assembly of the machine. It is sometimes referred to as leakage radiation.

c. Secondary radiation. This is radiation emitted by any substance through which X-rays are passing. It consists of longer wavelengths, coming from the X-ray tube and housing and from the soft tissues of the area being radiographed. It may sometimes be referred to as a scattered radiation.

Exercises (603):

Identify factors concerning the hazards and types of radiation by placing either a T or F in the block to indicate whether the following statements are true or false. Explain any false statements.

____ 1. The most important consideration in the field of dental radiography is obtaining high-quality diagnostic radiographs.

____ 2. X-rays produce about the same harmful effects as sunburn.

____ 3. Carelessness and indifference on the part of the technician are the most common causes of overexposure to X-rays.

____ 4. Inexperienced technicians have a tendency to overlook the potential hazards of X-rays because the X-rays are not apparent.

____ 5. The cumulative effects of radiation are important since two normally safe doses of radiation applied within a short timespan can together equal a harmful dose.

____ 6. The type of radiation emitted by substances through which X-rays are passing is called indirect radiation.

____ 7. The useful beam is classified as primary radiation.

604. State the safety practices and equipment features related to protection from overexposure by X-radiation.

Protection from Overexposure by X-ray. The operator must observe certain safety practices to insure proper protection from overexposure by X-rays. Follow closely the recommendations for proper protection against all types of radiation. Certain protective measures are built into exposure rooms, such as the adequate shielding of the walls and doors to prevent X-rays from passing through them and exposing personnel in adjacent areas. The safety measures we discuss in this section are those over which the operator has control:

a. The operator must be in the proper position during exposures. This includes standing away from the tubehead, out of the line of the useful beam, and behind an adequately shielded protective barrier.

b. Personnel specifically assigned to the dental radiographic section (not to include the entire dental clinical staff) must wear a thermoluminescent dosimetry (TLD) badge, more familiarly known as a film badge. This badge must be worn at chest level. Each film badge is issued by the environmental health section and is for use only by the individual in whose name it was issued.

c. Protective clothing, such as a leaded rubber apron with protective collar, must be worn by patients during every exposure. Remember never to fold or crease the apron, as this will create cracks in the leaded material and make the apron unsafe for use. Always hang the apron freely from a wall mount or a rack when it is not being used.

d. The X-ray film should be held by the patient or a mechanical film holder while the exposure is being made. The film should never be held by the dentist or the technician. A parent or guardian should hold the film for small children.

e. The tube and head assembly of the machine should not be held by hand during exposures.

f. The door of the exposure room should be closed when you expose radiographs. This is done to protect patients and coworkers in areas near the exposure room from unnecessary exposure to radiation.

g. The number of exposures of a particular patient should be held to a minimum, consistent with the diagnostic requirements. In other words, do not take exposures that are unnecessary.

h. Never make repeated radiographic exposures using human patients to develop a technique or for practice. Commercially available skulls, such as the Dexter II, should be used for this purpose.

i. Care must be exercised in moving the tubehead to and from the working area. Avoid striking the tubehead against the dental unit, wall, or other structures. Damage to the tubehead could result in the leakage of radiation.

j. Fertile women who are assigned to the dental radiographic section should be aware of current Air Force safety requirements. Also, check the records of female patients for entries indicating pregnancy and ask the dental officer if it is safe before making radiographic exposures on a pregnant patient.

As mentioned in the preceding paragraphs, the *film badge must always be worn* (at chest level) by personnel assigned to the radiography section. Please note that you do not wear the badge anywhere on the neck collar of your uniform as this is shoulder level and reduces the effectiveness of the badge. Rather, place the badge on a pocket or button seam area at chest level. The badge is worn at chest level to measure whole-body radiation. This film badge is part of a radiation monitoring program, designed to protect personnel working in certain radiation areas. The badge worn in the dental radiography section contains special films that provide a permanent record of the X-radiation received by personnel working there. If you are assigned to the radiography section, be sure to wear the provided film badge. It is for *your* protection.

The film badge consists of a plastic case that is roughly the size of a book of matches. The badge contains one or two film packets that are approximately the size of dental periapical film packets. An alligator-type clip is provided on the back of the film badge. This clip makes it easy for you to attach the film badge to the outer part of your uniform.

Personnel from the Environment Health Section collect these film packets at predetermined intervals (usually monthly) and forward them to the USAF Radiological Health Laboratory, Brooks AFB, Texas, for evaluation. There, the films are developed under carefully controlled conditions and evaluated. If abnormally high radiation dosages are detected, a message, so stating, is hurriedly dispatched to the originating environmental health section. Such a message usually triggers a comprehensive investigation. Dosages considered to be normal are recorded and forwarded quarterly.

If you are assigned a film badge, it should be worn at all times when you are working in the radiography section. You should *not*, however, wear the badge outside the radiographic section. Instead, you should always place your badge in the designated safe-storage area. This is an area located in the dental clinic that is free from exposure to direct sunlight, radiant heat, or other types of radiation. Exposing a film badge to these elements could affect the highly sensitive films used in the film badge. Therefore, it is to your advantage to wear and store the film badge, as we have indicated. Carelessness on your part may result in a waste of time and expense in an investigation, or possible endangerment to your health because of an undetected overdose of X-radiation.

In addition to the safety precautions you must observe when you are exposed to radiographs, the manufacturers of modern X-ray equipment provide some built-in safety features. These features offer additional protection by means of filtration and collimation. Although most modern X-ray units are adequately equipped with these built-in devices, frequently they are altered by technicians who are not familiar with them. Let us discuss filtration and collimation and determine how they provide protection.

Filtration. Filtration is an important element in the control of emerging radiation. Inherent filtration is the amount produced by the X-ray tube inclosure itself and is expressed as an equivalent thickness of aluminum. An additional aluminum disk is usually located where the rays exit the tubehead. This is done to increase the total filtration of the useful beam to at least 2.5 mm of aluminum. The inherent filtration, along with the aluminum disk, absorbs poor quality, long wavelength radiation, which would normally be absorbed by the patient's soft tissues and which is not of any diagnostic value. Be sure not to remove the aluminum filter. It protects the patient from useless radiation.

Collimation. Collimation limits the area of exposure on the patient. It is accomplished by the use of the lead diaphragm, which is usually located just in front of the aluminum filtration disk. Without this diaphragm, radiation emerging directly from the tubehead exposes an area approximately 6 inches in diameter at the patient's skin surface. This must be reduced, by collimation, to an area not more than 2 3/4 inches. Collimation restricts the X-ray beam to the area of interest. This restriction drastically reduces unnecessary exposure to the patient's throat and eye areas. (See fig. 1-2.) A recently developed lead-lined, rectangularly shaped pointer tube is also available to further reduce the area of exposure at the patient's skin surface.

Exercises (604):

1. What safety feature is built into the exposure room?

2. Where should the operator stand during X-ray exposures?

3. What protective clothing should be fitted to patients receiving multiple exposures?

4. Is it permissible for the X-ray technician to hold the film in position for the patient during an exposure?

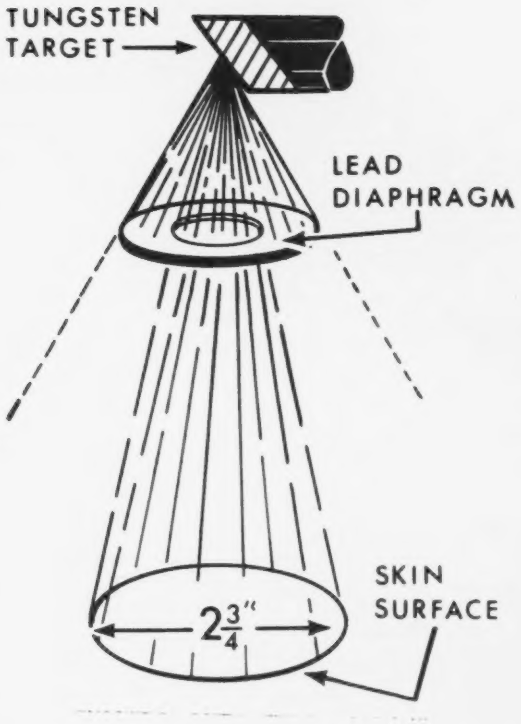


Figure 1-2. Collimation.

5. Why should the door of the X-ray room be closed during exposures?

6. What should be used in place of human patients to develop or practice radiographic techniques?

7. Why must you avoid striking the X-ray tubehead against the dental unit, walls, or other objects?

8. Why is the X-ray film badge worn at chest level?

9. What action occurs if the USAF Radiological Health Laboratory detects abnormally high radiation dosages on a packet from a film badge?

10. Why should you not wear the film badge outside the dental clinic?

11. How does *filtration* protect the patient from useless radiation?

12. How does *collimation* protect the patient from unnecessary radiation?

1-2. Dental Radiographic Film

Radiographic films are available that have the characteristics needed to produce a diagnostic radiograph. The inherent characteristics of the films include satisfactory speed, desirable contrast, and convenient size. In addition, the films allow sufficient latitude to compensate for small errors made in exposure time and the X-ray absorption of the area being radiographed. The film also permits unavoidable fluctuations in the current to the X-ray machine, without affecting the completed radiograph. Because of the various oral structures to be viewed, different types of radiographic film must be used.

605. Name the types of dental X-ray film, and state their characteristics.

Types. Radiographic films are made in different sizes, to be used in making the two general classes of dental radiographs: intraoral and extraoral. Intraoral radiographs are made by placing the film packets inside the mouth; these require small films. Extraoral radiographs are made by placing film holders or cassettes adjacent to the head or face and directing the X-rays through the area being radiographed. Larger films are used in making extraoral radiographs. Refer to figure 1-3 as we discuss the individual film types.

Periapical film. Periapical film is the film most commonly used. It is used to radiograph the crowns, roots, and supporting structures. The periapical X-ray film has an embossed dot on the tube side of the film to permit identification of the lingual aspect of the image. There is a printed dot on the film packet which corresponds with the embossed dot on the film. When you make an exposure, be sure that this printed dot is toward the occlusal or incisal surface of the teeth. This will insure that the embossed dot is not superimposed over the apical region of the teeth.

Bitewing film. The interproximal, or bitewing, film is used principally to locate cavities on the interproximal surfaces of the teeth and interproximal bone height. It permits viewing of the crown portion of the tooth and a small area of the root. To hold the film in position, the patient's teeth lock in on a tab attached to the film packet.

Occlusal film,. The occlusal film, a larger film, is placed horizontally between the occlusal surfaces of the upper and lower teeth. The occlusal film is occasionally used to obtain a general view of the maxillary or mandibular arch. This type of film is especially useful in locating foreign bodies in the floor of the oral cavity and impacted teeth, cysts, etc., in the palate. There are usually two films in the occlusal

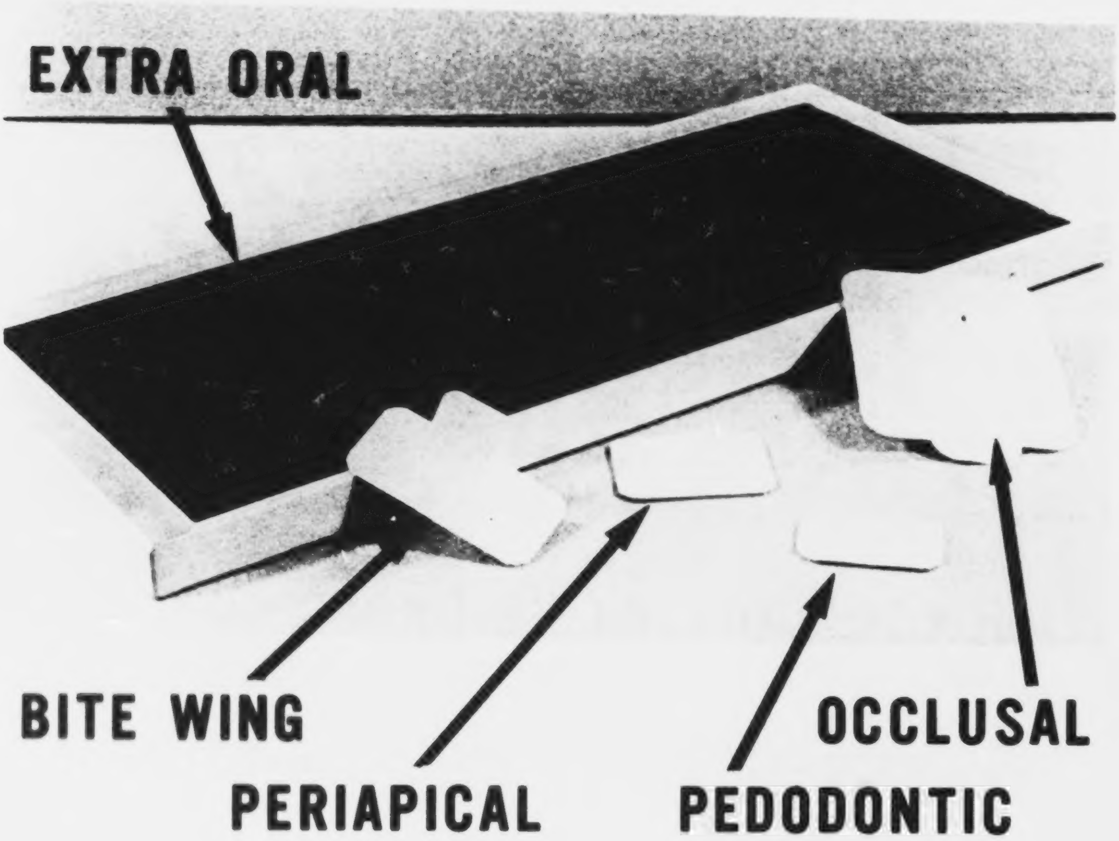


Figure 1–3. Types of radiographic film.

packet to allow for different developing times. By using different developing times you can provide the dentist with two different film contrasts: one for hard oral structures and one for soft oral tissues.

Pedodontic film. Pedodontic or "Pedo film," as it is commonly referred to, is a smaller version of the periapical film. It is used to obtain periapical-type radiographs of children or adults with extremely small mouths.

Extraoral films. Extraoral films are used to obtain a panoramic view of the oral structures and to view specific facial bones, sinuses, or the temporomandibular joint (TMJ). Extraoral films must be loaded into cassettes prior to use. A cassette is a hinged, lightproof aluminum box that contains two intensifying screens that fluoresce when exposed to X-rays. The screens light up and produce a more intense exposure of the film without requiring an increase of exposure time. Extraoral films may be used to supplement the findings of periapical and occlusal radiographs. They are valuable in the diagnosis of dislocations of the mandible, impacted teeth, malignancies, foreign bodies, sinus involvements, and fractures.

General Characteristics. Radiographic film consists of a transparent, cellulose base, coated on one or both sides with an emulsion. The emulsion is composed of silver halides in gelatin and is very sensitive to both X-rays and light. When the film is exposed to X-rays, the energy from this exposure is stored in the emulsion. This produces a latent image. However, this image cannot be detected by ordinary physical methods and must be immersed in certain chemicals to become visible. This occurs when the developer solution causes a chemical reaction and transforms the exposed silver halides into a black metallic silver. The amount of silver suspended in the emulsion produces different shades on the processed radiograph. These shades may vary from gray to black. Areas not exposed to X-rays will appear clear.

The various types of film have different speeds. This means that they vary in their sensitivity to X-rays. This sensitivity affects the amount of exposure time and the detail of the completed radiograph. The two speeds of film used by the Air Force are intermediate (medium fast type B) and ultraspeed (super type D). The manufacturers of the different films use their own trade names to identify each speed.

Film used for intraoral radiographs is supplied in packets of different sizes. The outside of these packets is both lightproof and waterproof. Inside the packet the film is sandwiched between black protective paper; this in turn is backed by lead foil. (See fig. 1-4.) The packet is pliable enough to be contoured to the correct position in the mouth, yet firm enough to resist excessive bending that would distort the radiographic image. The lead foil backing in the film packet prevents secondary radiation (which scatters from the oral tissues) from fogging the film.

Unlike intraoral film, extraoral film is not packaged in individual lightproof and waterproof packets. Therefore, the individual sheets of the film must be removed from the packaging container and loaded into cassettes located in the darkroom.

X-ray films must be protected through proper storage. These films must be kept in a cool, dry place, or they will deteriorate rapidly. X-ray film should never be kept near steam lines or radiators. An ideal place for the bulk storage of X-ray film is in a refrigerator. Since many chemicals affect films adversely, never store the films near areas where chemicals are kept. Exposure to the vapors usually present in such places may result in the decomposition of the film. Since films are sensitive to X-rays, they must be kept in lead-lined containers if stored in or near the exposure room. When several films are to be exposed, they should be taken one at a time from the dispenser, exposed, and placed into a lead-lined receptacle or behind a lead-lined screen. This protects them from secondary radiation.

Boxes containing extraoral films should be stored so that the films are standing on edge and not lying flat. This method of storage will prevent them from being pressed together which may damage the film. A minimum film stock should be maintained. The oldest film should be used first so that the film stock will always be fresh and will not exceed the exposure limit date.

Exercises (605):

1. What type of dental X-ray film is most commonly used to view the crowns, roots, and supporting structures of the teeth?

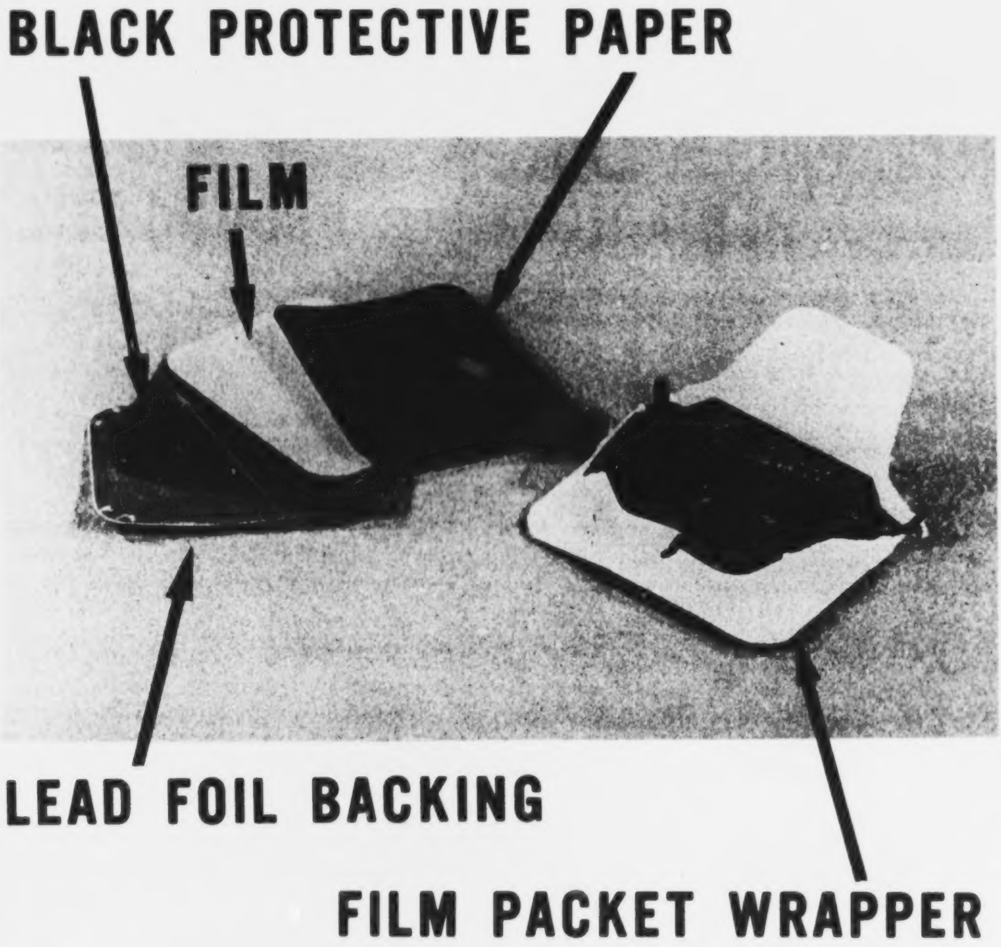


Figure 1-4. Contents of film packet.

2. How should the embossed dot on the periapical film packet be positioned when you are making an exposure? Why?

3. What type of film is used principally to locate cavities on the interproximal surfaces of the teeth?

4. What type of view is the occlusal film occasionally used to obtain?

5. Why are there usually two films in the occlusal film packet?

6. What name applies to the smaller version of the periapical film?

7. How must extraoral films be used?

8. How do the intensifying screens in a X-ray cassette function?

9. What is used to coat the transparent cellulose base of the X-ray film?

10. What is produced when X-rays strike the film's emulsion?

11. What must be done to make the latent image on the X-ray film visible?

12. What are the two speeds of dental X-ray film stocked by the Air Force?

13. Describe the construction of an intraoral film packet.

14. What is the purpose of the lead foil backing in the film packet?

15. Why must extraoral film be removed from the packaging container and loaded into cassettes located in the darkroom?

16. Where should X-ray film be stored?

17. In what position should boxes containing extraoral film be stored?

1-3. Exposing the Radiographs

The acceptable technique for exposing intraoral radiographs is the long-cone technique. In this section we will discuss the long-cone technique, which minimizes dimensional distortion and presents the objectives being radiographed in their true anatomical relationship and size.

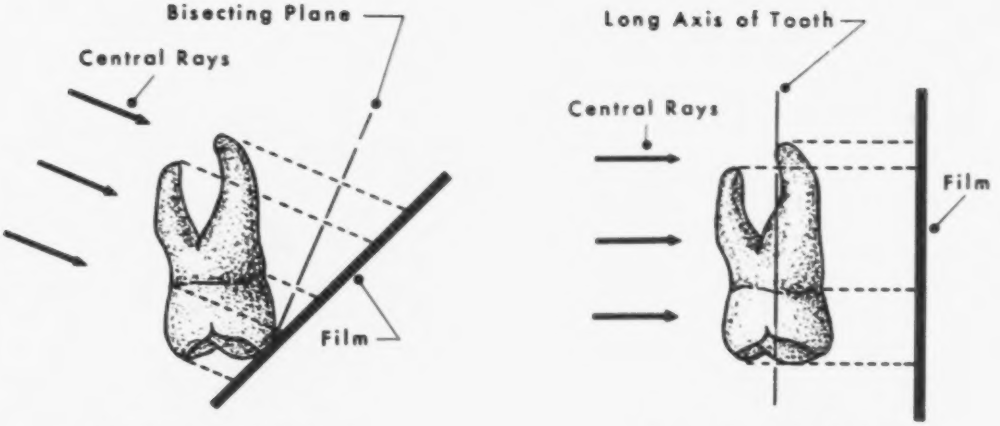
606. State the principle of the long-cone radiographic technique.

Objective of the Long-Cone Technique. The objective of the long-cone technique is to direct the X-ray beam perpendicular to the recording plane of the film, which has been positioned parallel to the long axis of the tooth. A comparison of the long and formally used short-cone principles is illustrated in figure 1-5. The long axis requires the use of extension cones, supplied by the manufacturer of the X-ray machine. The extension cone increases the focal (target) film distance from approximately 8 inches to 16 or 20 inches. With the longer focal-film distance, enlargement of the image is reduced (see fig. 1-6). Additionally, with the increased target-film distance, the exposure time must be increased. Read the film manufacturer's instructions for the recommended exposure time. Normally, long-cone radiographs are exposed at 90 kV, 15 mA.

Exercises (606):

1. State the objective of the long-cone radiographic technique.

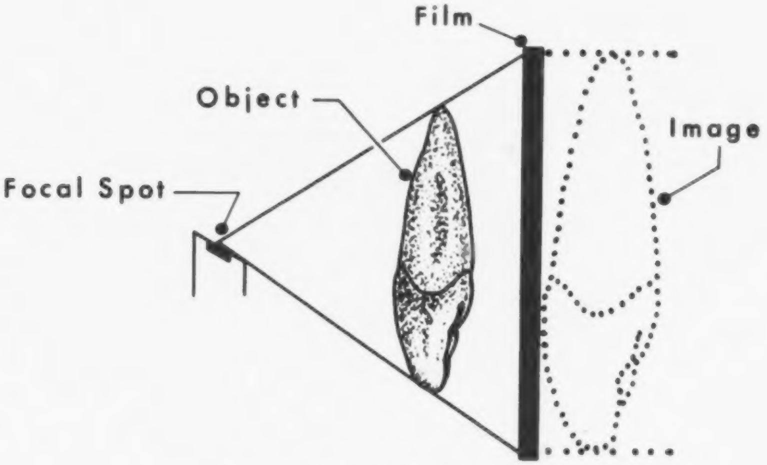
2. What target-film distance is employed with the long-cone technique? Why?


Bisecting Plane
Central Rays
Film
Long Axis of Tooth
Central Rays
Film

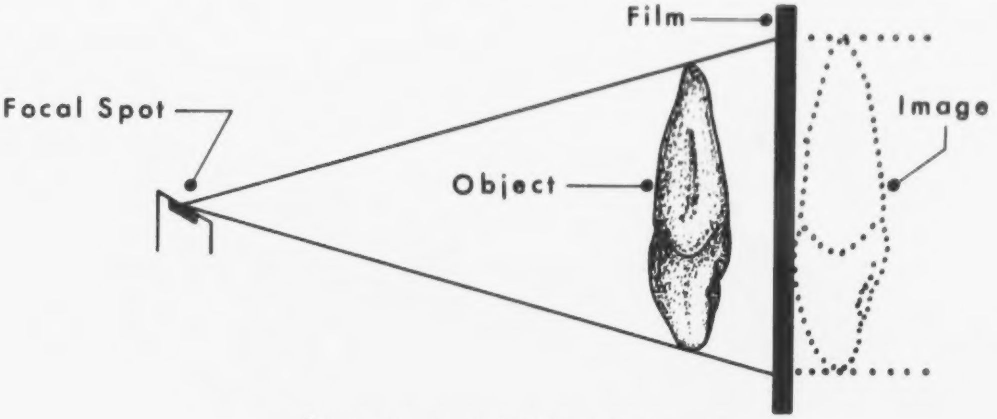
Short Cone Technique

Long Cone Technique

Figure 1-5. Long-cone principles.


Film
Object
Image
Focal Spot

8 inch Focal-Film Distance


Film
Focal Spot
Image
Object

16 inch Focal-Film Distance

Figure 1-6. Comparison of focal-film distance.

3. What adjustment in the exposure time must be accomplished when you employ the long-cone technique?

607. State the purpose of the X–C–P instrument, specify how it is assembled, and identify its components.

The X–C–P Instrument. The variety of anatomical conditions of the mouth presents problems in obtaining a parallel relationship between the film packet, the structures to be radiographed, and the tubehead. These difficulties usually can be overcome by the use of intraoral film holders, such as the Rinn X-tension C-one P-aralleling (X–C–P) instrument (shown in fig. 1-7). When you use this instrument, it is not necessary to maintain the patient in the standard dental radiographic position. By rotating or tipping the patient's head, or by adjusting the dental chair to a convenient position, it is usually possible for you to align the extension tube with the X–C–P instrument, regardless of space limitations or the restricted mobility of the X-ray unit. Alignment of the extension tube with the X–C–P instrument can also be accomplished with the patient in a supine position. This requires minimal maneuvering of the X-ray unit, with the final alignment being made by adjusting the patient's head. Placement of the film is simplified and well tolerated by the patient in this position.

Two X–C–P instruments assist in taking long-cone radiographs. One is for anterior exposures; the other is for posterior exposures. Both the anterior and posterior

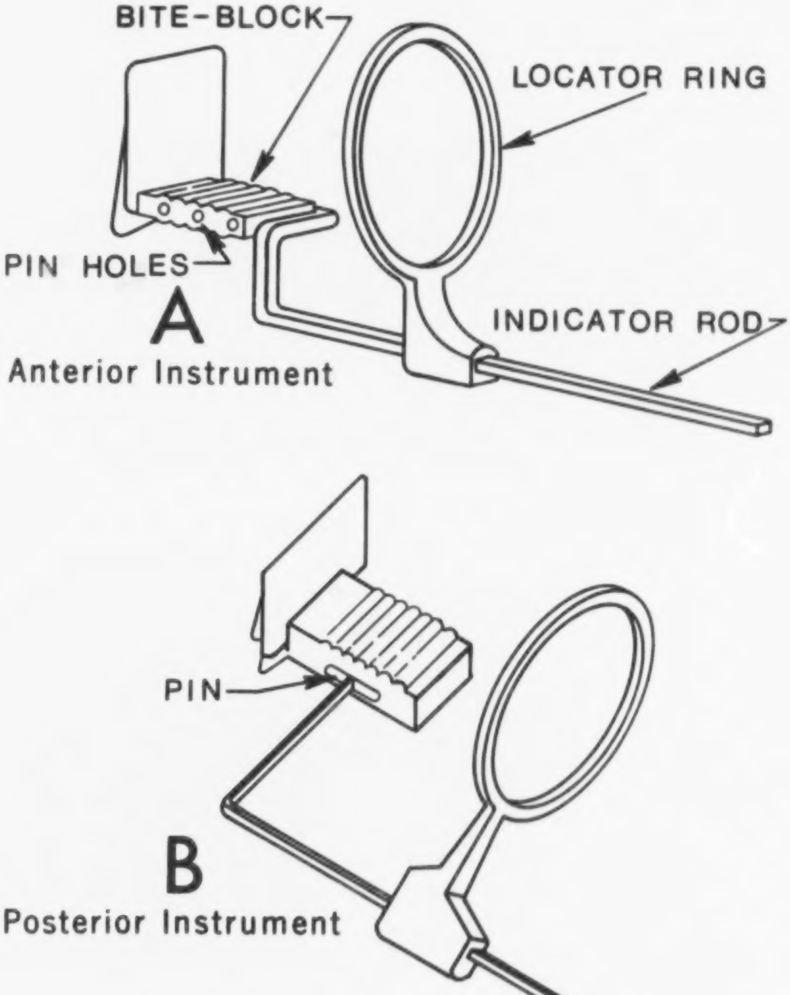


Figure 1–7. X–C–P instrument.

instruments consist of a bite-block, an indicator rod, and a locator ring. (See fig. 1-7.) The anterior bite-block back support is designed to hold the film's long axis in the vertical position while the posterior bite-block back support holds the film in the horizontal position. You can easily distinguish between the indicator rods. The posterior rod has a long, straight extension that bends off the main shaft at a 90° angle to attach to the bite-block. The extension off the main shaft of the anterior rod consists of a series (3) of short 90° bends. The plastic locator rings differ in that the anterior ring's neck is considerably shorter than that of the posterior ring.

For anterior exposures (fig. 1-7,A), place the shielded (printed) side of the film packet against the backing support of the bite-block. Insert the film vertically into the slot by using a downward motion. At the same time place slight pressure against the backing support to open the slot. Hold the offset portion of the indicator rod away from the biting surface of the block. Insert the pins into the proper holes. Slide the plastic locator ring onto the indicator rod so that it is in front of the film packet. The instrument is now ready to position in the mouth.

For posterior exposures (fig. 1-7,B), place the shielded (printed) side of the film packet against the backing support of the bite-block. Insert the film horizontally into the slot by using a downward motion. At the same time place slight pressure against the back support to open the slot. Hold the right-angle portion of the indicator rod anterior to the block and away from the film. Insert the pins into the proper holes. There are three holes in the bite-block to allow a choice for lingual positioning of the film. Slide the locator ring onto the indicator rod so that it is in front of the film packet. The instrument is then ready to position in the mouth.

Exercises (607):

1. What is the purpose of the X–C–P instrument?

2. Must the patient be maintained in the standard radiographic position when you use the X–C–P instrument?

3. Distinguish between the parts of the anterior and posterior X–C–P instruments by matching the description in column B to the part listed in column A.

Column A	*Column B*
____ (1) Anterior locator ring.	a. Designated to hold the film in a horizontal position.
____ (2) Posterior indicator rod.	b. Has a long, straight extension that bends off its main shaft at a 90° angle.
____ (3) Posterior bit-block.	c. Designed to hold the film in a vertical position.
____ (4) Anterior indicator block.	d. A plastic, ring-shaped object, having a short neck.
____ (5) Anterior bit-block.	e. A plastic, ring-shaped object, having a long neck.
	f. Its extension consists of a series of short 90° bends.

4. When you place the film packet in the X–C–P instrument, which side of the packet should be placed against the backing support of the bite-block?

5. Briefly describe how the posterior X–C–P instrument is assembled. (Omit the film placement.)

608. List the positioning procedures involved in taking long-cone radiographs; state the proper longitudial film position, the alignment, the X–C–P instrument, and the procedure employed for edentulous patients; and identify the teeth upon which the film should be centered.

Specific Periapical Radiograph Exposures—Long-Cone. Use periapical radiograph exposure technique only as a guide to help you understand its principles. When placing the film in the patient's mouth for long-cone exposures, do not attempt to place the film directly against the teeth. Position the film towards the midline if you want the proper parallelism. (See fig. 1-8.) With this in mind, let us study how we set up for the specific exposures.

a. Maxillary incisor region. To radiograph the maxillary incisor region, assemble the anterior instrument. Center the film packet with the midline, and parallel it with the long axis of the incisors. The entire length of the block should be utilized to position the film in the region of the first molar. Rest the block on the incisal edges of the teeth you want to radiograph. Insert a cotton roll between the mandibular incisors and the block. Ask the patient to close firmly his or her mouth to retain the established position of the film. Slide the locator ring down the indicator rod to approximate the skin surface and align the extension tube of the X-ray unit with the rod and ring along the vertical and horizontal planes. This procedure is shown in figure 1-9.

b. Maxillary cuspid region. To radiograph the maxillary cuspid region, assemble the anterior instrument with the film inserted vertically. Center the film on the cuspid, and parallel it with the long axis of the tooth. Rest the block on the maxillary cuspid. Then, insert a cotton roll between the mandibular teeth and the block. Now, instruct the patient to close firmly on the block to retain the established position of the film. Slide the locator ring down the indicator rod near the skin surface. Finally, align the extension tube of the X-ray unit with the rod and ring on vertical and horizontal planes. (See fig. 1-10.)

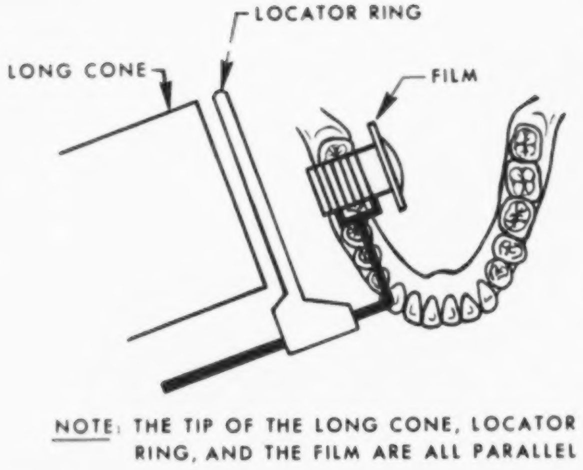

LOCATOR RING
LONG CONE
FILM
NOTE: THE TIP OF THE LONG CONE, LOCATOR RING, AND THE FILM ARE ALL PARALLEL

Figure 1–8. Paralleling in the long-cone technique.

c. Maxillary bicuspid region. To radiograph the maxillary bicuspid region, assemble the posterior instrument with the film inserted horizontally in the bite-block. Position the film in the mouth with the second bicuspid centered on the film. Parallel the film with the long axis of the bicuspids. Hold the bite-block on the occlusal surfaces of the maxillary bicuspid. Now, insert a cotton roll between the bite-block and the mandibular teeth. Instruct the patient to close firmly to retain the established position of the film. Next, slide the locator ring down the indicator rod to approximate the skin surface. Finally, align the extension tube of the X-ray unit with both the rod and ring on horizontal and vertical planes. (See fig. 1-11.)

d. Maxillary molar region. To radiograph the maxillary molar region, assemble the posterior instrument with the film inserted horizontally in the bite-block. Position the film in the mouth with the second molar centered on the film. Parallel the film with the long axes of the molars. Next, place a cotton roll between the underside of the bite-block and the mandibular molars. Now, ask the patient to close firmly to retain the established position of the film. Slide the locator ring down the rod to approximate the skin surface. Finally, align the extension tube of the X-ray unit with both the rod and ring along the horizontal and vertical planes. (See fig. 1-12.)

e. Mandibular incisor region. To radiograph the mandibular incisor region, assemble the anterior instrument and insert the film vertically in the bite-block. Center the film with the midline, and parallel it with the long axes of the incisors. Lingual placement of the film packet to the region of the second bicuspid will accomplish this. Now, rest the block on the incisal edges of the teeth to be radiographed. Next, insert a cotton roll between the top of the block and the maxillary incisors. Ask the patient to close firmly to retain the established position of the film. Slide the locator ring down the indicator rod to approximate the skin surface. Finally, align the extension tube of the X-ray unit with the rod and ring on vertical and horizontal planes. (See fig. 1-13.)

f. Mandibular cuspid region. To radiograph the mandibular cuspid region, assemble the anterior instrument with the film inserted vertically in the bite-block. Center the film on the cuspid and parallel it with the long axis of the tooth. Now, rest the block on the mandibular cuspid and insert a cotton roll between the block and the maxillary teeth. Next, instruct the patient to close firmly to maintain the established position of the film. Slide the locator ring down the indicator rod to approximate the skin surface. Finally, align the extension tube with the rod and ring on vertical and horizontal planes. (See fig. 1-14.)

g. Mandibular bicuspid region. With the posterior instrument assembled and the film inserted horizontally in the block, position the film in the mouth with the second bicuspid centered on the film. Parallel the film with the long axes of the bicuspids. Next, place the block on the occlusal surfaces of the mandibular bicuspids. Now, insert a cotton roll between the block and the maxillary teeth. Have the patient to close firmly to retain the established position of the film. Slide the locator ring down the indicator rod to approximate the skin surface. Finally, align the extension tube with the rod and ring on horizontal and vertical planes. (See fig. 1-15.)

h. Mandibular molar region. To radiograph the mandibular molar region, assemble the posterior instrument with the film inserted horizontally in the bite-block. Position the film in the mouth with the second molar centered on the film. Next, parallel the film with the long axes of the molars. Now, place a cotton roll between the block and the opposing maxillary teeth. Have the patient close firmly to retain the established position of the film. Slide the locator ring down the indicator rod to approximate the skin surface. Align the extension tube with the rod to approximate the skin surface. Finally, align the extension tube with the rod and ring on horizontal and vertical planes. (See fig. 1-16.)

i. Edentulous patients. To radiograph partially edentulous patients, place a cotton roll in the space normally occupied by the crowns of the missing teeth and then follow the standard procedure. For completely edentulous patients, tape cotton rolls to the bite-block to fill the space normally occupied by the crowns of the teeth. Parallel the film with the ridge area being examined. Now, have the patient close down to hold the film in the desired position. It may also be necessary for you to vary the standard technique for patients with variations in the shape of the oral structures, such as low palates and malpositioned teeth.

Exercises (608):

1. In what position should the long axis of the film packet be positioned for exposures of the incisors and cuspids?

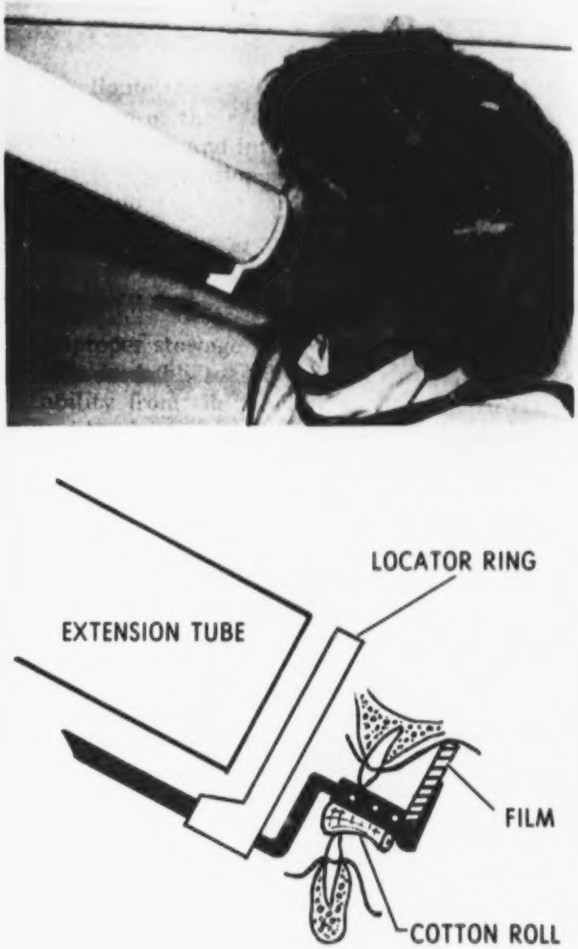


Figure 1-9. Maxillary central incisors.

2. Match the film position in column B to the radiograph in column A.

Column A

____ (1) Incisor regions.
____ (2) Biscuspid regions.
____ (3) Cuspid regions.

Column B

a. The anterior edge of the film should be in the vicinity of the first molar-second biscuspid contact point.
b. The second biscuspid is centered on the film.
c. The midline is centered on the film.
d. The film is centered behind the cuspid.

3. When you use the long-cone technique with the X-C-P instrument, what is near the patient's skin surface?

4. What is aligned next to the X-C-P locator ring when you take long-cone radiographs?

5. When you radiograph edentulous or partially edentulous patients, what should you do prior to taking the exposure?

609. State the purpose of bitewing radiographs and specify the proper patient, film, and central ray positioning needed for their exposure.

Bitewing Technique. The interproximal or bitewing examination is primarily used to reveal the presence of caries in the crowns of the teeth, particularly early lesions

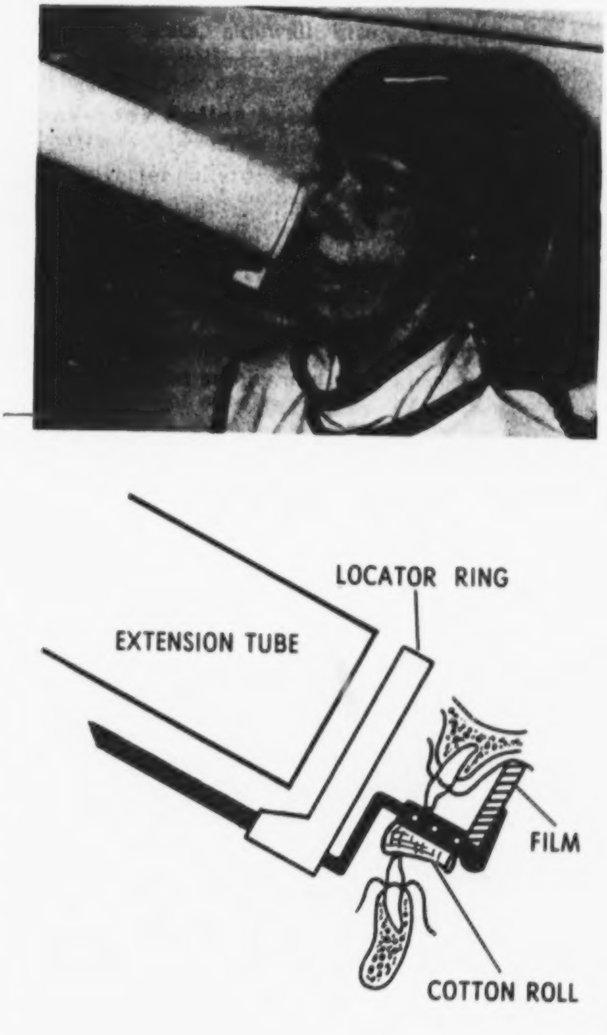


Figure 1-10. Maxillary cuspid.

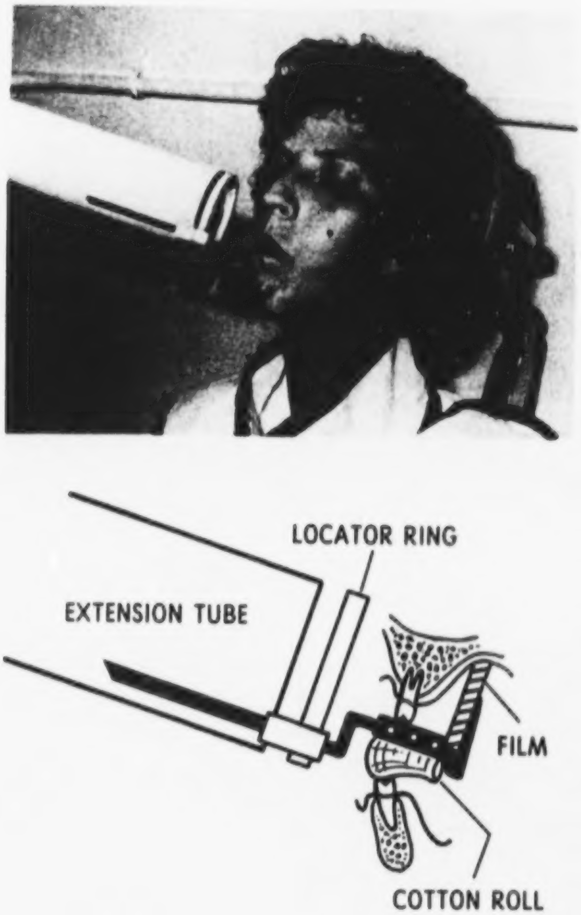


Figure 1-11. Maxillary bicuspid.

on the interproximal surfaces. During this examination, we are also able to observe certain changes in the pulp chambers and pulp canals, the presence of overhanging fillings, improperly fitting crowns and fixed partial dentures, and resorption or destruction of the crest of the alveolar bone.

The posterior interproximal exposure is the standard procedure for taking a posterior bitewing radiograph. The median sagittal plane must be vertical and the ala-tragus line, horizontal. Have the patient close his or her teeth firmly on the bite tab. Place the film packet so that its greatest dimension lies in a horizontal plane, parallel with the long axis of the crown of the teeth. The forward edge of the film packet should be placed behind the distal one-third of the most anterior cuspid (maxillary or mandibular). This insures that the entire crown of both the maxillary and mandibular first bicuspid appears on the radiograph. Do not permit the film to rotate as the patient closes his or her mouth. Direct the central ray toward the occlusal plane at the center of the packet. (See fig. 1-17.) The pointer should read about 8° below the centerline for proper vertical angulation. Look straight through the maxillary second bicuspid-first molar contact area for proper horizontal angulation. Accuracy is essential to avoid the overlapping of structures.

Exercises (609):

1. For what purpose are bitewing radiographs primarily used?

2. What is the proper position for the exposure of bitewing radiographs?

3. How should the film be positioned for bitewing radiographs?

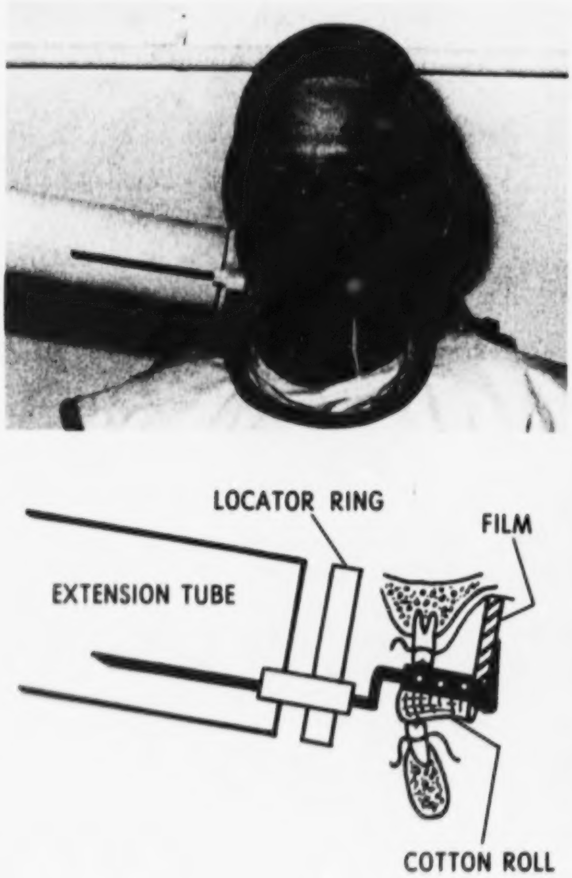


Figure 1-12. Maxillary molar.

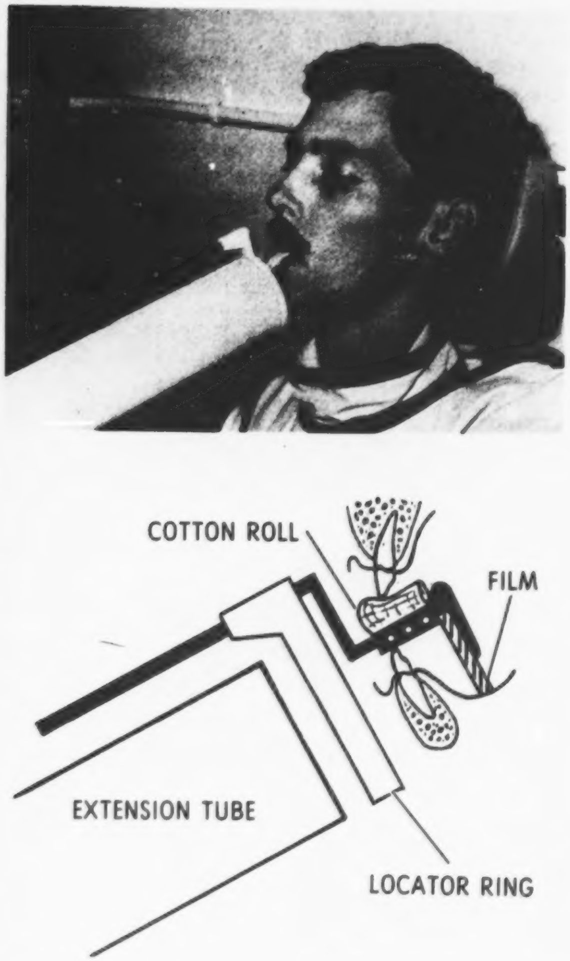


Figure 1-13. Mandibular central incisors.

4. How should the central ray be directed for the exposure of bitewing radiographs?

610. State the purpose of the occlusal examination, and identify the conditions in which the occlusal radiograph could have great diagnostic value.

Occlusal Radiographic Examination. The occlusal examination is so called because the film packet is placed in the occlusal plane for exposure. It is a supplementary procedure that allows the dental officer to view many oral conditions from a cross-sectional aspect that cannot be achieved with other types of intraoral film. These radiographs are of great value in the diagnosis of antral involvements; the relationship of foreign bodies in the jaw or maxillary sinuses, bone fractures, presence of salivary calculi (stones); and the location of areas of bone involvement, cysts, impacted teeth, and malignancies.

Exercises (610):

1. Generally speaking, what does the occlusal examination allow the dental officer to view?

2. Place an X next to each oral condition below in which an occlusal examination would prove to be of great diagnostic value.

____ a. Periapical abscess.
____ b. Maxillary bone fracture.
____ c. Salivary stones.
____ d. Dental granuloma.
____ e. Foreign bodies in a sinus.
____ f. Periodontitis.
____ g. Impacted teeth.
____ h. Gingivitis.

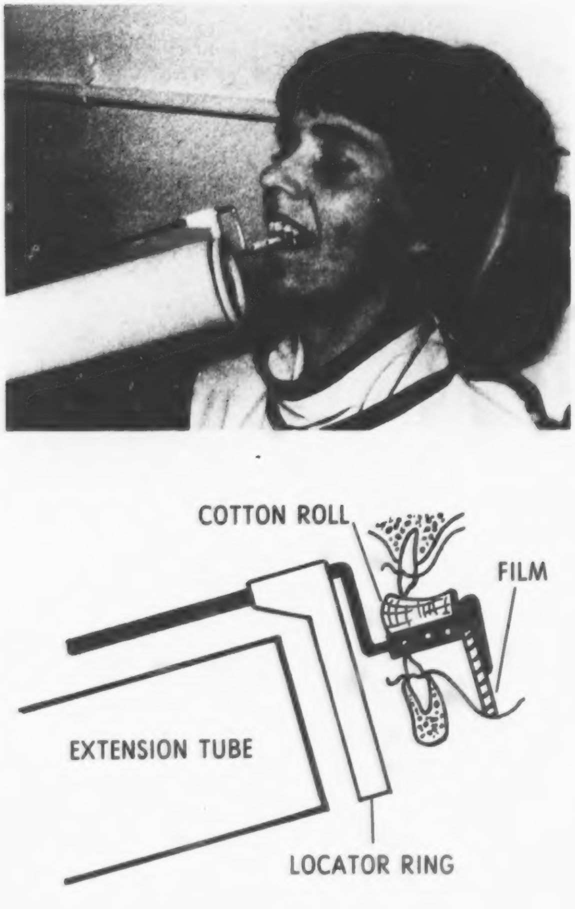


Figure 1-14. Mandibular cuspid.

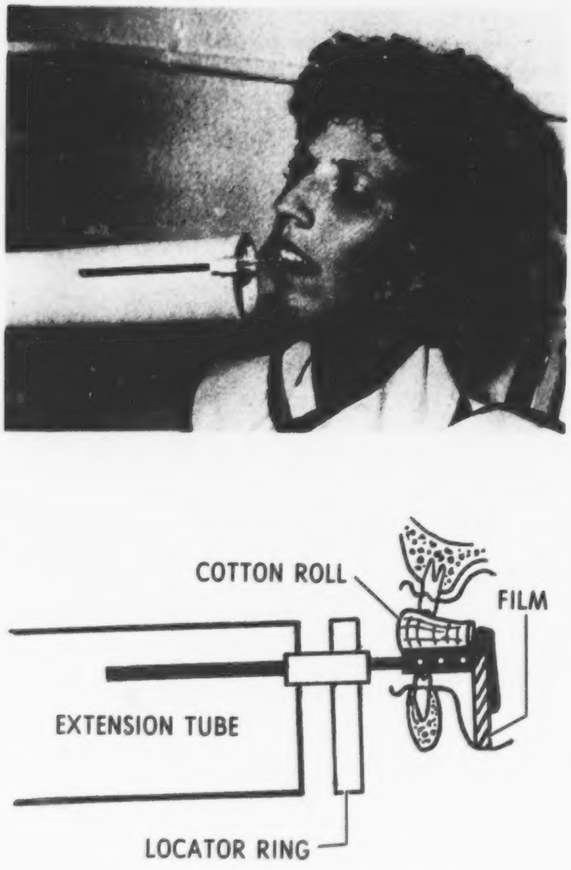


Figure 1–15. Mandibular bicuspid.

611. Given a series of statements concerning the occlusal exposure technique, indicate which are true and which are false.

Occlusal Exposure Techniques. The occlusal film packets, previously discussed, are normally used to record occlusal radiographs. In the cases of children, or adults with extremely small mouths, a periapical film packet may be substituted for the occlusal packet. For both maxillary and mandibular exposures, the patient's median sagittal line should be kept in the vertical plane. Position the patient's ala-tragus line parallel to the floor for maxillary exposures. During mandibular exposures, tilt the patient's head back until the ala-tragus line is perpendicular with the floor.

Position the film packet so that its recording plane faces the structures you want to radiograph. Insert the film packet into the patient's mouth and ask the patient to bite firmly, but slowly, on the packet so that it retains its position.

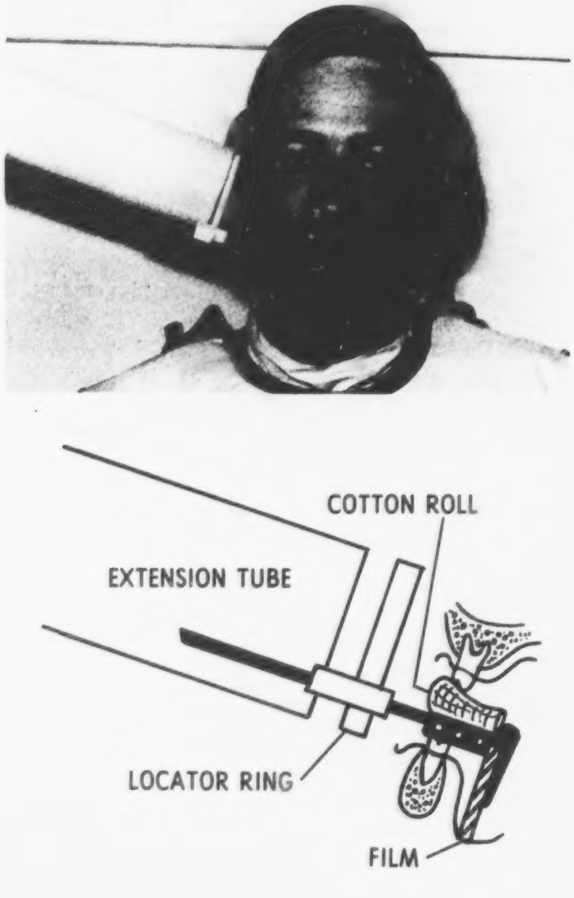


Figure 1–16. Mandibular molar.

Figure 1-17. Bitewing technique.

Exercises (611):

Indicate whether the following statements are true or false by placing a T or F in front of the statement. Explain any false statements.

____ 1. In the cases of children, or adults with extremely small mouths, a periapical film packet may be substituted for the occlusal packet.

____ 2. During occlusal exposures the patient's median sagittal line should be kept in the vertical plane.

____ 3. The patient's ala-tragus line should be positioned parallel to the floor for mandibular exposures.

____ 4. The film packet should be positioned so that its recording plane is facing the structures to be radiographed.

____ 5. You can retain the position of the film packet by having the patient press on it firmly with his or her thumb or forefinger.

612. Given procedures necessary for the production of various occlusal radiographs, match each procedure with the specific radiograph to which it applies.

Specific Occlusal Exposures. The following paragraphs describe the procedures involved in the setup for several specific occlusal examinations. Figures 1-18 through 1-23 illustrate these setups. Use the exposure time, kVp, and mA settings recommended by the film's manufacturer.

Maxillary topographical occlusal. As with all maxillary exposures, the patient's ala-tragus line should be parallel

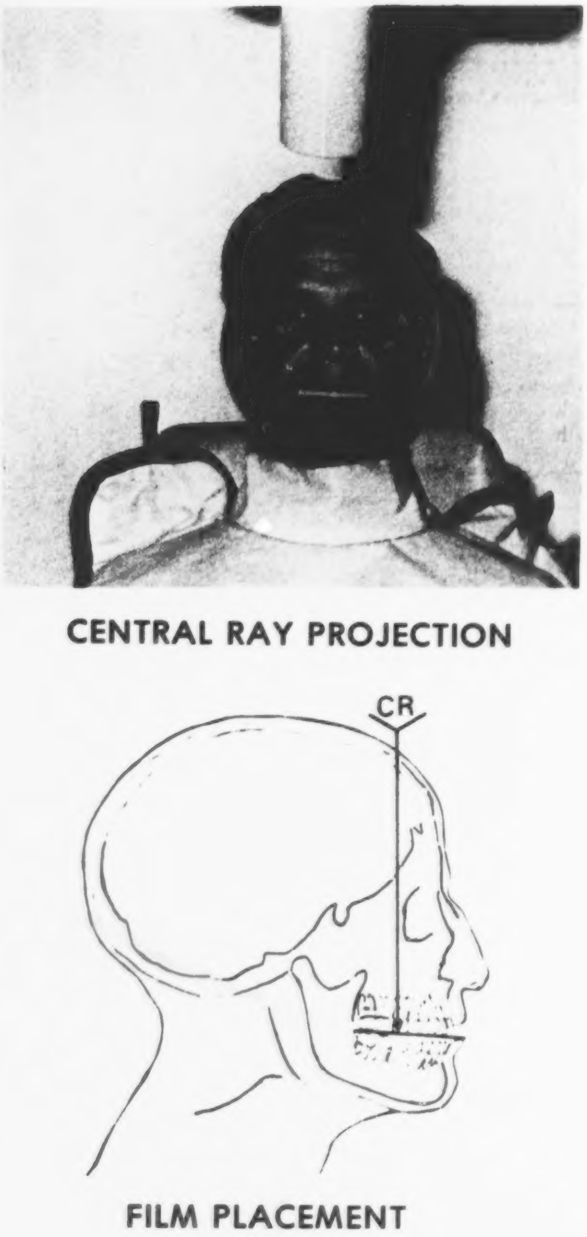
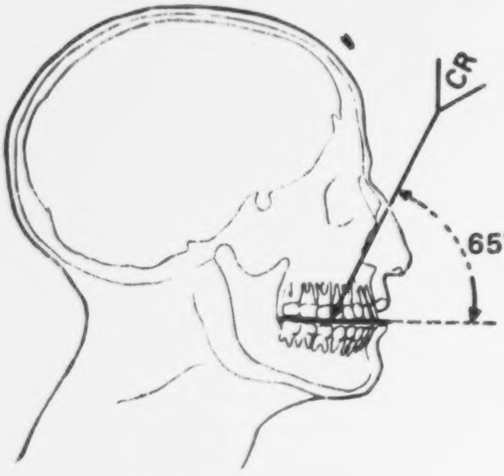


Figure 1-18. Maxillary topographical occlusal.

with the floor. Place the film packet in the mouth with its long dimension extending across the mouth. Be sure the film is placed far enough distally to include all the teeth, then ask the patient to bite down gently on the film packet. Next, adjust the tubehead so that the central ray enters along the median line at the top of the head. When you view it from the side, align the path of the central ray with the outer corner of the patient's eye. The cone tip should be directed straight down (90°) toward the film packet. See fig. 1-18.

Maxillary anterior occlusal. Again, position the patient so that the ala-tragus line is parallel with the floor. Place the film in the mouth with its short dimension extending across the mouth and ask the patient to bite down gently on the film packet. Direct the central ray to enter at 65° downward in the midsagittal plane, at the interior border of the nasal bones. (See fig. 1-19.) Look between the central incisors to establish proper horizontal angulation.

CENTRAL RAY PROJECTION



FILM PLACEMENT

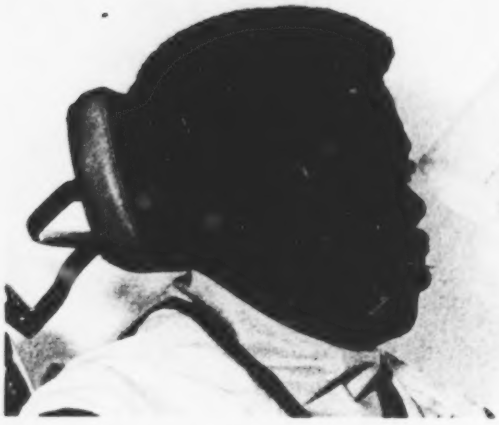
Figure 1–19. Maxillary anterior occlusal.

Maxillary posterior occlusal. You should parallel the patient's ala-tragus line with the floor. Position the film in the mouth, on the side to be radiographed, with its long axis parallel to the median plane. The line aspect of the film packet that lies toward the cheek should be parallel with the facial cusps and should extend at least 1/4 inch beyond the facial cusps of the posterior teeth. Ask the patient to hold the film in position by gently biting on the film packet. Next, adjust the tube to a vertical angulation of 60° downward. Finally, direct the central ray to pass through the ala of the nose toward the apical region of the cuspid and the first bicuspid to the plane of the film packet. (See fig. 1-20.)

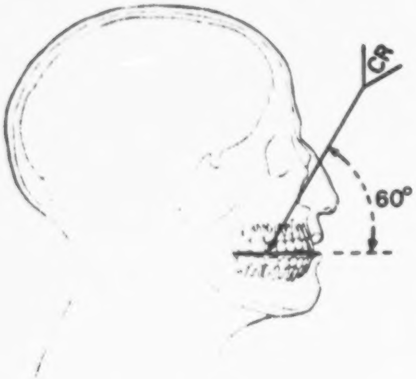
Mandibular topographical occlusal. Tilt the patient's head backward so that the ala-tragus line and occlusal plane of the teeth are perpendicular to the floor. Keep the median facial plane in a vertical position. Place the film packet in the mouth with its long axis extending across the mouth. Be sure the film is placed far enough distally to include all the teeth. Ask the patient to bite gently on the film packet. The central ray should be directed perpendicular to the recording plane of the film packet; this, of course, means using 0° vertical angulation. Position the tube pointer under the chin on the median line at a spot between the mandibular first molars. The ray should pass through the floor of the mouth to the center of the film. (See fig. 1-21.)

Mandibular anterior occlusal. Tilt the patient's head backward so that the ala-tragus line and the teeth are perpendicular to the floor. Keep the median facial plane in the vertical position. Next, place the film in the mouth with its lesser dimension extending across the mouth. Ask the patient to bite down on the film packet. Next, adjust the tube to a vertical angulation of 35° downward. Finally, position the tube so that the central ray enters at the median line of the chin just below the apices of the mandibular central incisors. (See fig. 1-22.)

Mandibular posterior occlusal. Tilt the patient's head backward so that the ala-tragus line and the teeth situate perpendicular to the floor. Keep the median facial plane in the vertical position. Place the film in the mouth, on the side to be radiographed, with its long axis parallel to the median plane. The long aspect of the film packet that lies toward the cheek should be parallel with the facial cusps and extend 1/4 inch beyond the facial cusps of the posterior teeth. Ask the patient to hold the film in position by gently biting on the film packet. Adjust the vertical angulation so that the central ray is directed perpendicular to the film packet. If you position the film packet perfectly perpendicular to the floor, use 0° vertical angulation. Direct the central ray so that it will pass from below the mandible and through the second molar to the center of the film packet. (See fig. 1-23.)



CENTRAL RAY PROJECTION



FILM PLACEMENT

Figure 1-20. Maxillary posterior occlusal.

Exercises (612):

1. Match the specific radiographs listed in column B to the procedures in column A. Each radiograph can be matched to more than one production procedure.

Column A

____ (1) Vertical angulation of 60° downward.
____ (2) Long axis of the film positioned across the mouth.
____ (3) Film positioned to lie parallel with an extend at least 1/4 inch beyond the facial cusps toward the cheeks.
____ (4) Short axis of the film positioned across the mouth.
____ (5) Central ray directed 65° downward at interior border of the nasal bones.
____ (6) Central ray direct 90° downward through the top of the the head.
____ (7) Position the tube pointer under the chin on the median line at a spot between the first molars.
____ (8) Direct the central ray 35° downward through the median line of the chin just below the apices of the mandibular central incisors.
____ (9) When the head is properly positioned, the vertical angulation is 0°.
____ (10) The central ray is projected 60° downward at the ala of the nose toward the apical region of the cuspid and first bicuspid.

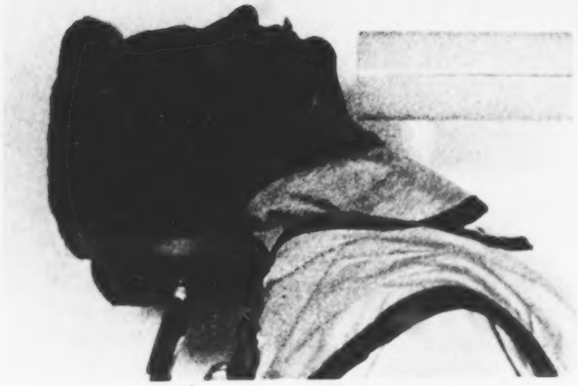
Column B

a. Maxillary topographical.
b. Maxillary anterior.
c. Maxillary posterior.
d. Mandibular topographical.
e. Mandibular anterior.
f. Mandibular posterior.

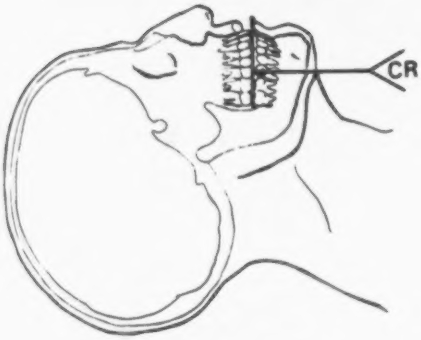
613. State the uses of extraoral radiographs in dentistry, and specify how they are produced.

Extraoral Radiographs. You may use extraoral radiographs to obtain a panoramic view of the patient's teeth and their surrounding structure or to view a specific bony area where an abnormality is suspected. The extraoral radiographs that are most often used in the dental clinic are the panographic radiographs. As the name implies, they provide a panoramic view of oral structures.

Panographic radiographs. The production of panographic radiographs requires special equipment (figs. 1-24 and 1-25 illustrate a panographic unit). The X-ray head and cassette of this unit rotate around the patient to obtain a complete view of the patient's oral structure. Panographic equipment helps to obtain a comprehensive survey of the patient's oral condition. With the use of the panographic procedure, the patient receives only about one-tenth the amount of radiation as in a conventional full mouth series. This process eliminates the need to place individual film packets in the patient's mouth and makes



CENTRAL RAY PROJECTION



FILM PLACEMENT

Figure 1-21. Mandibular topographical occlusal.

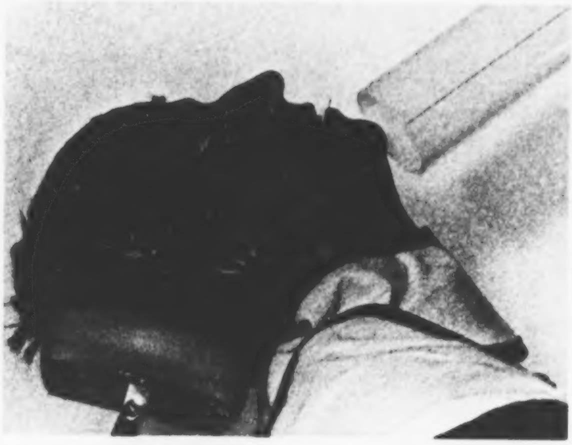
the panographic technique develop much faster. There is, however, some degree of distortion with all panographic radiographs. Usually, the dental officer will order periapical films of any questionable areas noticed on the panographic radiograph. Because of this distortion factor, the panographic technique is fairly limited to obtaining full-mouth surveys. Because there are variations in the operation of panographic equipment supplied by different manufacturers, you should read the applicable instructions before you attempt any exposures.

Other extraoral radiographs. Use the other extraoral radiographs are to view a specific part of the anatomy. They may be requested if you suspect a fracture or if the patient experiences temporo mandibular joint problems, sinus pain, etc. Obtain these radiographs by having the patient hold the cassette against the structure you plan to radiograph and by directing the central ray toward the cassette from the opposite side of the patient's head. Although you may use dental X-ray units to expose these radiographs, you usually get better results by having them exposed and processed by the medical X-ray section. Many dental radiography textbooks describing a multitude of extraoral techniques are available for reference should you need to expose extraoral radiographs with a dental X-ray unit.

Exercises (613):

1. How are extraoral radiographs employed in dentistry?

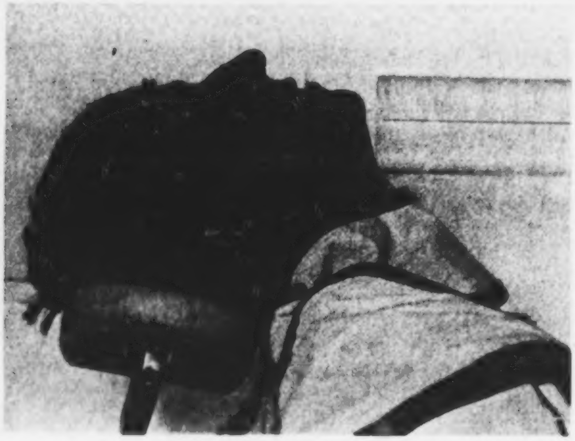
2. How does the panographic unit perform to provide a complete view of the patient's oral structure?



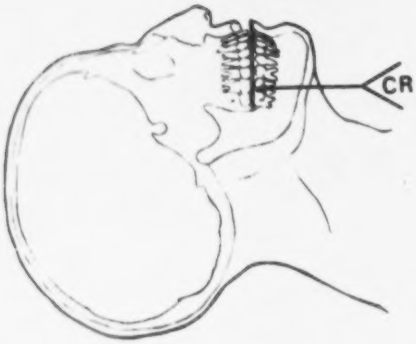
CENTRAL RAY PROJECTION

FILM PLACEMENT

Figure 1-22. Mandibular anterior occlusal.



CENTRAL RAY PROJECTION



FILM PLACEMENT

Figure 1-23. Mandibular posterior occlusal.

3. Why is the panographic technique primarily limited to fullmouth surveys?

4. How are extraoral radiographs of specific bony areas obtained?

1-4. Processing X-Ray Films

Precise methods in processing X-ray films are as essential as the use of precise exposure techniques. Following the correct procedures gives you the assurance that you are providing radiographs of the highest quality. On the other hand, by not following directions you nullify all the care that was exercised during the exposure of the films. The processing procedure, using various processing techniques, is carried out in a photographic darkroom.

614. State the factors necessary for a properly constructed darkroom; describe the darkroom's contents; and specify how it functions.

The Darkroom. Since the films used in X-ray work are extremely sensitive to white light, it is very important to have an effective darkroom. It need not be a large room, but it must be constructed so that no light can enter. In addition, the door should have an inside lock so that no one can accidentally open it or enter as you process film. Another type of construction plan for the darkroom is a maze that has enough turns to keep out light. Because of the way darkrooms are constructed, they should have good ventilation. The use of some forced change of air employing a ventilation fan is advisable.

Darkroom illumination. For the illumination of the darkroom, use a light that is photographically safe. There are numerous types of safelights available. You can easily test the safety of the safelight illumination in the darkroom by darkening the room and opening the radiographic film packet under safelight illumination. Then, place the film on the worktable beneath the safelight. Next, place a coin or paper clip on the open film. Finally, expose it to the safelight for 1 minute and process the film. If you can see the profile of the object, the safelight illumination is not safe.

Processing tank. A suitable tank for processing films is an important part of the darkroom equipment. (See fig. 1-26.) The tank should be constructed of corrosion-resistant and rust-resistant material. Compartments or divisions are provided for the developing and fixing solutions, plus a larger section for water. Since it is essential to process film at the predetermined temperature, the tank must be equipped with a thermometer that will register the exact temperature of the developer solution. This developing temperature can be partly controlled by a supply of hot and cold water. Most tanks are equipped with refrigeration units that maintain the proper temperature. If you do not equip the processing tank with a refrigeration unit, the incoming pipes should lead to a mixing valve so that you can regulate the temperature of the waterflow.

Automatic processor. The Air Force now equips darkrooms with automatic processors. (See fig. 1-27.) It is relatively simple to operate this equipment. You unwrap the film and feed it into a slot on the automatic processor. A conveyor system transports the film through the automatic developer's chemicals, and the processed film is turned out in about 5 minutes. This equipment is available through several manufacturers, and you should be thoroughly familiar with the operating and maintenance instructions furnished by the particular manufacturer of your equipment. We will discuss the processing tank, interval time, and film holders in this section. They all relate to the

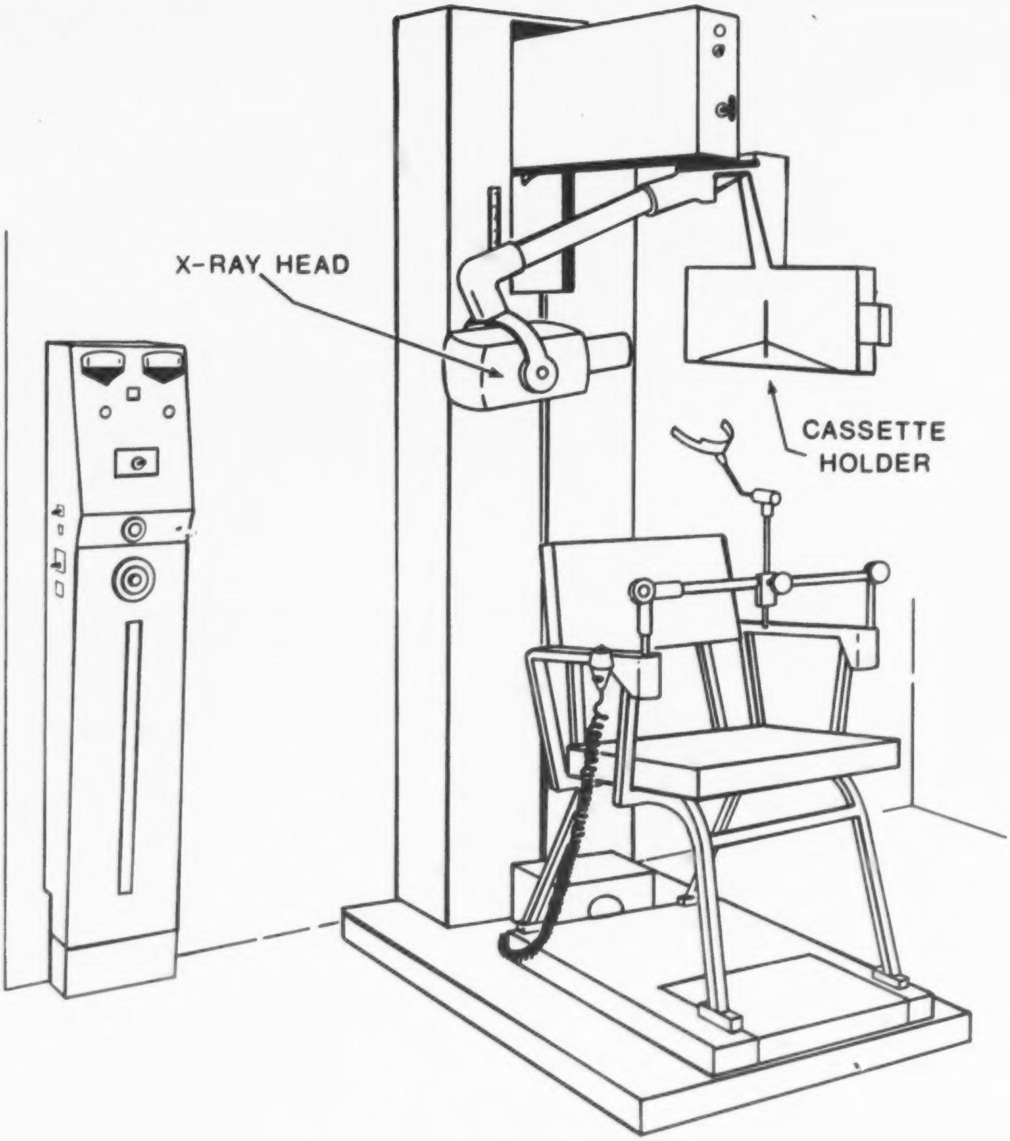


Figure 1-24. Panographic X-ray unit.

manual processing method. Do not confuse them with the automatic processing method.

Interval timer. Because of the direct relationship between temperature and time in the processing procedure, it is necessary to know the exact time that you should leave any given film in each solution. For this purpose, an interval timer is needed in the darkroom. This timer gives the time in minutes and fractions of minutes and is equipped with an alarm, which sounds to indicate the expiration of the time selected.

Film holders. Two types of film holders or hangers should be available in the darkroom. (See fig. 1-28.) One type is for intraoral film and the other, for extraoral film. Handle film carefully and place it on the hangers to avoid getting your fingerprints on the film.

Exercises (614):

1. Why is it necessary to develop radiographic film in a darkroom?

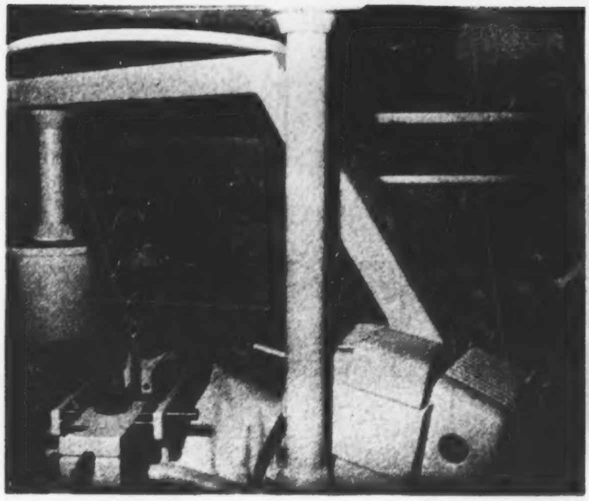


Figure 1-25. Panographic X-ray unit with patient.

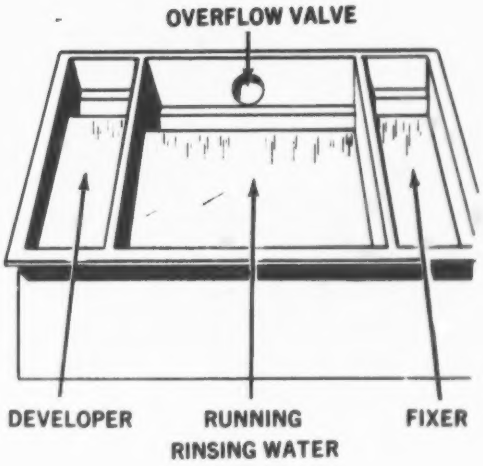


Figure 1-26. X-ray film processing tank.

2. List the factors that are necessary for an adequately constructed darkroom.

3. How can you determine if your darkroom illumination is adequate?

4. Describe the radiograpahic processing tank.

Figure 1-27. Automatic film processor.

Figure 1-28. Film holder.

5. How may the temperature of the processing solution be controlled?

6. Briefly describe how film is developed in the automatic developer.

7. What is used to indicate the amount of time the film has spent in the processing solutions?

615. State dental radiographic film processing procedures.

Time-Temperature Processing Technique. The procedures we discuss in this section apply to the manual processing tank and not to the automatic processor. If you use the automatic processor, follow the manufacturer's instructions because several steps are necessary for processing radiographs when you use the time-temperature processing technique. The first step identifies the film.

Film identification. Since there are usually several processing racks in use in the darkroom at any given time, it is necessary to have some way to identify which patient's films are on which rack. One way of doing this is to number each rack and assign a rack number to each X-ray patient. The patient's name and rack number may be recorded in an X-ray logbook, or the number may be recorded onto the patient's AF Form 644, Record of Dental Attendance. After you have processed the films, they can be identified by matching the rack number to the patient number.

Film placement on racks. After identifying the film, you are ready to process it. The processing must, of course, be done inside the darkroom. First, remove the film from its packet and securely attach it to the film rack. If the film is not secured on the rack, it will fall to the bottom of the processing tank. Needless to say, retrieving film from the bottom of the tank is a difficult and dirty task. Now the film is ready to be placed in the first processing solution—the developer.

Developing. Generally speaking, when you place radiographic films in a developing solution, the surface tension of the film prevents the solution from fully contacting the film. You can see the results of this phenomenon in the form of tiny air bubbles, which seem attached to the film. When left uncorrected, portions of the film go undeveloped. The result is an inferior quality radiograph. To eliminate the bubbles and increase the quality of the radiograph, agitate the rack for a few seconds immediately after you place it in the developing solution.

The amount of time required for developing X-ray film depends on the temperature of the developer solution. The ideal time-temperature ratio of the developer 5 minutes at a temperature of 68° F. However, allow for variations. The following table indicates the amount of time that you should leave a film in the developer solution at a certain temperature:

Temperature (Degrees Fahrenheit)	*Time (Minute)*
60	6½
65	5½
68—Ideal	5
70	4
75	3

Since the time-temperature ratio is so critical when you process radiographic film, it is advisable to post the processing table in a conspicuous place in the darkroom. When you use fresh developer solution, it may be necessary to reduce the developing time by a minute or more. When you have used the developer solution for a period of time, it may be necessary to extend the developing time by a minute or more.

Keep the developer solution in the left-hand section of the processing tank. When placing films in this solution, the silver halides that were affected by the X-rays are converted to a black metallic silver. The developer solution does not affect unexposed silver halides. Since developing time is most critical, a floating thermometer should be kept in this section of the tank. Check the temperature of the developer before you begin film processing.

A developer solution that is too old, too exhausted, or too cold will not properly develop a film. The chemicals in a developing solution are gradually exhausted by use. Also, exposure of the solution to air, heat, or light will cause deterioration by oxidation. Therefore, keep the tank filled at all times, keep the solution cool, and keep the solution covered to protect it from light. New solution may be added to the tank from time to time to avoid an abrupt change in potency. However, depending upon the number of films developed, it will be necessary to renew the solution at intervals. If the developer has become a dark brown color, it should be discarded and replaced with fresh solution. The average length of time that the solution is effective in the dental clinic is about 2 weeks. Mix new solutions in accordance with their manufacturers' instructions. Keep in mind that manufacturers of some radiographic processing chemicals have warned that excessive inhalation and contact with skin can be dangerous. For this reason, always wear protective glasses or goggles, a face mask, gloves, and an apron when mixing, replacing, or adding solutions in processing tanks.

Rinsing. The running water in the center section of the processing tank should be approximately the same temperature as the developer solution and the fixer solution. After the developing is complete, the film should be moved into the center rinsing section of the processing tank and agitated from 15 to 30 seconds for the purpose of rinsing off all traces of the developer solution. The water should be shaken from the film. Next, place the film in the fixer solution. The developer solution must not be carried into the fixer solution. Likewise, do not mix the fixer solution with the developer solution.

Fixing. Keeping the fixer solution in the right-hand section of the processing tank removes the unaffected halide salts and hardens the emulsion. Films should be briskly agitated when they are placed in the fixer solution and left there for approximately 10 minutes. All of the foregoing steps are accomplished in the darkroom with no light except the safelight.

Washing. From the fixer solution the films are placed in the water in the center rinsing section of the processing tank for washing. Washing them for at least 20 minutes in running water prevents a discolored film and also keep the fixer solution from dropping on the floor, where it forms an unsightly white spot.

Drying. Thoroughly dry films after they have been processed. The time involved depends on the humidity and circulation of air. Films should never be dried in a temperature exceeding 100° F., or near a source of heat such as a radiator, because such a practice results in curled film.

Exercises (615):

1. What is the purpose of numbering the X-ray film racks?

2. What is the first step of the processing procedure that must be done entirely in the darkroom?

3. What processing difficulty can result from the surface tension of the film and what should you do to eliminate this problem?

4. What is the ideal time-temperature ratio for developing dental radiographic film?

5. What portion of the processing tank contains the developer solution?

6. In what portion of the processing tank should the floating thermometer be kept? Why?

7. How does the developing solution affect the film?

8. When should the developing solution be discarded and replaced with fresh solution?

9. What should you do immediately after the interval timer has signaled that the film has spent its allotted time in the developer solution?

10. What portion of the processing tank contains the fixer solution?

11. How long should the films remain in the fixer solution?

12. After the fixing of the film has been completed, how long should the film be washed?

13. What is the maximum temperature at which films can be dried without danger of curling?

616. State the procedure for mounting radiographs; and given a list of anatomical landmarks, identify the radiographs on which they may be seen.

Mounting Periapical Radiographs. A full-mouth radiographic series consists of 14 periapical and 2 bitewing films. These films are usually mounted in a cardboard folder called an X-ray mount (see fig. 1-29). This mounting permits convenient handling of the radiographs while viewing, and it also makes filing easier. Always mount the films for viewing from the lingual aspect, as though the viewer were sitting on the patient's tongue, looking out of the mouth. The mounts have slots into which you slide the film. Place the film into the mount in the same sequence that the teeth appear in the mouth. You should place the central incisor view in the center of the mount; a cuspid view on each side of the central incisor view; a bicuspid view distal to each cuspid view; and a molar view distal to each bicuspid view. Now that we know how the films are placed in the mount, let us see how we identify the various views.

The first step in mounting radiographs is to determine the aspect from which you view the film. As you should recall, an embossed dot is located on one corner of the film. This dot appears as a bump on one side of the film and as a depression on the other side of the film. To properly mount the radiographs, look into the depression because that provides the lingual aspect of the radiograph.

Next, we identify the radiographic view. Several anatomical features aid us in making this determination. We have listed many of these features below:

a. The *maxillary sinus* is usually quite prominent on the maxillary cuspid, bicuspid, and molar views. It appears as a large darkened area above the root tips and is often inscribed by thin white lines.

b. The *nasal spine* can usually be seen on radiographs of maxillary central incisors. It appears as a white line, about 1/4-inch thick, which descends from the top of the film down to about the root tips. Darkened areas, called nasal passages, appear on each side of the nasal spine.

c. The *maxillary tuberosity* can usually be seen on maxillary molar views. This tuberosity appears as a bulge of bone, located distal to the maxillary third molar.

d. The *mandibular canal* can sometimes be seen on the mandibular molar and bicuspid views. This canal, when visible, appears as a dark line that begins in the third molar area and travels horizontally just below the root tips. Quite often you can see small vertical extensions from this line to the apex of the tooth.

e. Usually, you can view the *mental foramen* on radiographs of the mandibular bicuspids. This natural opening in the bone appears as a dark dot, which is located slightly below the bicuspid teeth.

f. The anterior portion of the *ramus of the mandible* can often be seen on mandibular molar radiographs. Normally, you can see the inner angle of the mandible and a portion of the ramus as it ascends toward the temporomandibular joint.

g. In addition to the anatomical features we have mentioned, the teeth themselves often offer clues to the identity of the radiograph. For example:

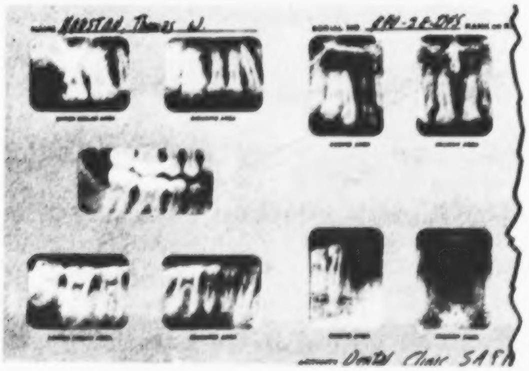


Figure 1-29. Mounted radiographs.

(1) Maxillary incisors and cuspids appear larger than their mandibular counterparts.

(2) Maxillary molars have three roots, whereas mandibular molars have only two roots.

(3) The shape and position of the teeth differ.

After you have identified the radiographic view, your last determination is whether it belongs on the right or left side of the mount. This is a simple procedure. First, make sure you are viewing the film from the lingual aspect. Then arrange the films so that the teeth appear as they do in the mouth. For example, the bicuspid view also shows the first molar; this film should be placed in the mount so that the bicuspids are the closest teeth to the midline.

Exercises (616):

1. In what sequence and aspect should films be mounted for viewing?

2. How can you determine if you are viewing the radiograph from the lingual aspect?

3. In the exercise below, match the anatomical feature or features listed in column B with the radiograph in column A. Some items may be used more than once.

	Column A	*Column B*
____	(1) Mandibular bicuspids.	a. Nasal spine.
____	(2) Maxillary central incisors.	b. Maxillary sinus.
____	(3) Maxillary molars.	c. Maxillary tuberosity.
____	(4) Mandibular molars.	d. Mental foramen.
____	(5) Maxillary cuspid.	e. Mandibular canal.
		f. Ramus of the mandible.

4. List the characteristics of the teeth that offer clues to the identity of a radiograph.

617. List the terms that relate to the visual quality of radiographs, and identify the causes of faulty radiographs.

Evaluation of Diagnostic X-Rays. You must be able to determine whether the radiographs you take are of diagnostic quality. This does not mean that you will make a diagnosis. There are a number of variables that you must consider when making your evaluation. Consider the visual quality of the image and whether you used the correct techniques for film placement, vertical angulation, horizontal angulation, projection of the central ray, exposure, and processing.

Visual quality of the image. Radiograph quality requires clear definition and maximum accuracy in the portrayal of the dental structures as they actually exist. The quality of the radiograph is determined by the sharpness of the image (detail); the degree of blackening of the film (density); and the difference between the black, white, and various shades of gray on the film (contrast).

Causes of faulty radiographs. Faulty radiographs result for many reasons. Sixteen common classes of faults are listed below:

(1) Thin image, caused by:

(a) Insufficent exposure or developing time.

(b) Use of excessively cold or exhausted developer solution.

(c) Use of diluted developer solution.

(2) Dense image, caused by:

(a) Excessive exposure or developing time.

(b) Use of too warm a developer solution.

(c) Use of a concentrated developer solution.

(3) Partial image, caused by:

(a) Film not being completely immersed in the developer solution.

(b) Film in contact with another film in the developer solution.

(c) The center beam of the X-ray focused off the film in periapical films or off-center in bitewing films so that it exposes only a portion of the film. The unexposed portion of the film is clear when it is processed. This error is called cone cutting.

(4) Foreign image, caused by:

(a) Eyeglasses, rubber dam clamps, removable partial dentures, amalgam in tooth sockets, and metal in tissues.

(b) Radiopaque objects in the X-ray unit cone.

(c) Fingers interposed between the film packet and the cone.

(5) Blurred image, caused by:

(a) Movement of the patient, film, or X-ray unit head.

(b) Double exposure.

(6) Distorted image, caused by:

(a) Film packet being bent during exposure.

(b) Improper angulation.

(7) Fogged image, caused by:

(a) Unintentional exposure of film to radiation because of improper storage.

(b) Use of over-age film that has been exposed to heat or chemical fumes.

(c) Improperly mixed or contaminated developer solution.

(d) Safelight screen being bleached, thin, or cracked.

NOTE: Fog appears as a dark gray on the film, with a loss of detail and an absence of the contrasting light elements of the picture. (The radiograph lacks contrast or sparkle.)

(8) Stained or streaked film, caused by:

(a) Dirty solution.

(b) Unclean film holders or hangers.

(c) Insufficient fixing or washing.

(9) Black spots, caused by bending the film packet to the extent that the packet cracks open and admits light.

(10) Fingerprinted films, caused by handling the films by flat surfaces instead of placing fingertips on the edges.

(11) Reticulation, caused by carrying the film from a warmer to a colder solution or using processing solution of over 75° F. Reticulation is a netlike appearance of the film. The film may appear to be covered with little globules.

(12) Herringbone image, caused by placing the wrong side of the film packet toward the source of the X-rays. Instead of a herringbone image, some film will show dots, squares, or the words "WRONG SIDE EXPOSED" when the film is processed.

(13) Bleached image, caused by leaving film in a freshly mixed fixer solution too long, especially at elevated temperatures.

(14) Black areas on film, caused by discharge of static electricity, due to pulling a film from its paper wrapping too rapidly in a dry atmosphere.

(15) Crescent-shaped lines, caused by damage to the emulsion, and resulting from sharp bending of the film packet.

(16) No image obtained on the processed radiograph, caused by:

(a) Electric plug not in, circuit breaker switch off, timer not lifted from hook, time button not pushed down hard, or the voltage compensator indicator not on a contact point.

(b) Film placed in fixer solution before being placed in developer solution.

(c) X-ray unit head not making proper contact with electric current supply, due to a loose locking collar.

Exercises (617):

1. Define the terms that relate to the visual quality of a radiographic image.

2. Identify the causes of faulty radiographs by matching the cause in column B to the fault listed in column A.

Column A

____ (1) Distorted image.
____ (2) Herringbone image.
____ (3) Dense image.
____ (4) No image.
____ (5) Bleached image.
____ (6) Partial image.
____ (7) Reticulation.
____ (8) Foreign image.
____ (9) Thin image.
____ (10) Blurred image.
____ (11) Black areas on the film.
____ (12) Fogged image.
____ (13) Stained or streaked film.

Column B

a. Insufficient exposure or developing time.
b. film left too long in freshly mixed fixer solution.
c. Improper angulation or excessive bending of the film packet.
d. Unintentional exposure of film to radiation because of improper storage.
e. Insufficient fixing or washing.
f. Using a solution over 75° F. or carrying the film from a warmer to a colder solution.
g. Placing the wrong side of the film packet toward the source of the X-rays.
h. Pulling the film from its paper wrapping too rapidly.
i. Placing the film in the fixer solution prior to the developer solution.
j. Movement of the patient, film, or X-ray unit head.
k. Not completely immersing the film in the developer solution.
l. Radiopaque objects in the cone of the X-ray unit.
m. Excessive developing or exposure time.

618. State the purpose of the dental X-ray analyzer quality control check and specify how it is used.

The Dental X-Ray Analyzer Quality Control Check. Although the Air Force purchases some of the finest dental X-ray equipment available, mechanical problems do occur. Obviously, trained medical equipment repair people cannot perform checks daily. Unless otherwise designated, this is the responsibility of the person(s) assigned to the dental radiographic section. To do this, we check the radiographic process daily by use of the dental X-ray analyzer quality control check.

Description. The analyzer check requires the following items:

a. An unexposed periapical film packet of the type required by the manufacturer of the analyzer to be used.

b. The X-ray analyzer. This device is nearly the same size as the film badge described earlier and consists of an outer casing (usually made of plastic) which surrounds an inner compartment. The inner compartment is made up of equal one-third widths of the following three basic materials placed side by side: plastic (1/3); aluminum (1/3); and lead (1/3). Each of these materials is of a predetermined thickness set by the manufacturer. (See fig. 1-30.)

c. The dental X-ray unit to make an exposure.

d. The dental radiographic processor to process the image.

e. The analyzer standard. This is usually a film and/or a chart supplied by the analyzer manufacturer, to be used as a measurement guide. p.5

Purpose. The dental X-ray analyzer check is a quick, simple method if the dental X-ray unit to determine is making accurate exposures using the correct amount of

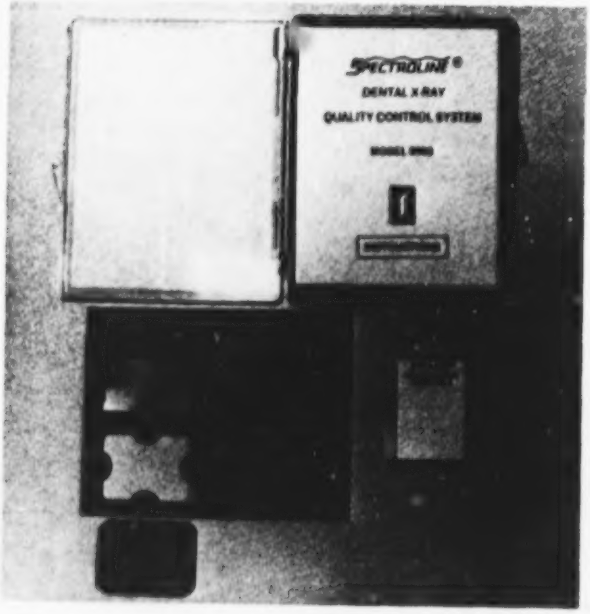


Figure 1–30. Dental X-ray analyzer.

radiation. It can also be used to check for defective film, improper methods of processing, and poor processing solutions.

Use. Before your first patient arrives, place a new, unexposed, periapical film packet (front up) on the arm or seat of the X-ray chair. Carefully rest the analyzer cartridge on top of the film packet, making sure that the film is completely covered. Next, turn on the dental X-ray unit and set the controls according to those required by the analyzer's manufacturer. Then, place the end of the X-ray cone so that it is parallel and directly over the analyzer and film. Finally, expose and process the film as you normally would. The processed film should contain the following three equally divided shaded areas: black (1/3); gray (1/3); and clear (1/3).

The dark black, shaded area is that area of the film that was directly under the plastic located in the analyzer. When the exposure was made, the radiation easily penetrated the plastic, completely exposing the film (black).

The gray shaded area was that area of the film that was directly under the aluminum portion of the analyzer. Some of the radiation got through.

The clear area was that area of the film that was directly under the lead portion of the analyzer. The lead in the analyzer did not allow the radiation to pass through, which prevented exposure of the film (clear).

The analyzer check is by no means complete until the exposed shaded areas of the film are matched with the analyzer's standard or control. This is the film or chart provided by the manufacturer. If all the shaded areas of the film you exposed match exactly with the analyzer manufacturer's standard, everything functions normally. If the shades do not match, check the film expiration date, and recheck the dental X-ray unit's controls and the processor's chemicals/temperature. Repeat another analyzer check. If, at this point, you determine it is not the processing or the film itself causing the error, notify your supervisor or the NCOIC and take the dental X-ray unit to be checked by a qualified repair person. DO NOT make any exposures on a patient until you correct the problem. Unless normal maintenance will solve the problem, DO NOT attempt to repair the equipment.

Exercises (618):

1. What is the primary purpose for conducting the dental X-ray analyzer quality control check?

2. What are some other purposes of the check?

3. Briefly describe when you would perform the analyzer check and the items needed.

4. In a short paragraph, describe the procedure for running the analyzer check.

5. What must you do if your first analyzer check does not match?

6. When is it permissible to make exposures on a patient after making the check?

CHAPTER 2

Preventive Dentistry

THE ADAGE "an ounce of prevention is worth a pound of cure" summarizes the theory of preventive dentistry—the use of measures to prevent oral diseases and also to prevent the progression of oral diseases. Because of the poor oral health conditions within the military, the USAF Preventive Dentistry Program was developed. It constitutes the most valuable and important element of the professional service provided by the base dental activity. Each Air Force dental activity must have the capability to provide a planned program of preventive dentistry.

2-1. Objectives of the Preventive Dentistry Program

For any program to be functional, it must have clear and precise objectives. The USAF Preventive Dentistry Program has excellent objectives as attested to by the notable reduction of oral disease within the Air Force.

619. List objectives, phases, and participants in the USAF Preventive Dentistry Program.

The objectives of the USAF Preventive Dentistry Program are to:

a. Prevent the occurrence, progression, and recurrence of oral disease.

b. Help patients establish a healthy oral environment.

c. Teach each patient how to maintain a healthy oral environment.

d. Facilitate patient self-learning and the acceptance of personal responsibility.

In order to meet these objectives, a continuing preventive dentistry program must be conducted at all Air Force installations that have a dental service capability. The program includes a clinical and community health phase and a dependent children's phase. It also includes in its range of services the periodic dental examination, oral prophylaxis as needed, topical application of fluorides, systemic use of fluorides, the use of fluoride dentifrices, and plaque control (including patient education and counseling, home care, dietary and nutritional instruction, and other techniques).

All dental personnel should participate in the Preventive Dentistry Program. Dental personnel should be provided with the information necessary for knowledge and understanding of the preventive dentistry philosophy and techniques. This information should be provided through the organized continuing education program on the base and through the proper local, state, and national professional meetings. Maximum use should be made of the training and ability of auxiliaries, to meet the needs of all areas of the program.

Exercises (619):

1. State the objectives of the USAF Preventive Dentistry Program.

2. What are the three phases of the preventive dentistry program?

3. Who should participate in the preventive dentistry program?

4. How are dental personnel provided the information necessary for knowledge and understanding of the preventive dentistry philosophy and techniques?

2-2. The Clinical Phase

The clinical phase of the program includes all aspects of preventive dentistry performed within the dental facility. It consists of a team effort that involves all areas of dentistry. This phase includes all professional treatment rendered to the patient at the dental clinic. This professional treatment includes a periodic dental examination; plaque control management and preventive dentistry counseling; dental prophylaxis; necessary treatment to restore the oral cavity to a healthy state; oral health program for food handlers; and mouthguards for participants in contact sports.

620. From a list of activities, identify those applicable to the clinical phase of the preventive dentistry program, and name five requested details concerning these activities.

Periodic Dental Examination. A periodic dental examination and a dental record review are scheduled for each Air Force member. These exercises the currency of dental health classification, early detection of oral pathology, and proper custody of dental health records.

Consolidated base personnel offices (CBPOs) furnish dental facilities with personnel rosters of officers and airmen according to organization and date of last exam. CBPOs also furnish each organizational unit with rosters and periodic dental examination notification cards. Each unit coordinates the scheduling of dental examinations with the dental facility. The unit sends annotated notification cards to advise members when to report for examinations.

At the time of the examination appointment, the plaque control concepts and techniques should be offered to eligible members and suitable appointments scheduled. If they are necessary, special examinations should be performed in conjunction with the periodic dental examination.

Plaque Control Management and Preventive Dentistry Counseling. Each patient is counseled on his or her dental health needs by a dentist or trained auxiliary on a continuing basis. Patient motivation can be achieved best by individualized programs that are positively oriented. This is important to maintain a high level of self-motivation. In addition to individualized counseling, plaque control lectures and small group counseling sessions, devoted to teaching special home care skills, may be used. Notation may be made indicating the individual's progress in control of dental plaque. Special examinations should be performed if indicated with patient counseling. Counseling should include:

a. Self-evaluation methods.
b. Plaque control techniques.
c. The use of adjunctive oral hygiene devices.
d. Diet and nutrition.
e. Interrelationship of oral health to general health.

Dental Prophylaxis. Provide a thorough dental prophylaxis to each active duty member, as required. This is an important part of the USAF Preventive Dentistry Program. The prophylaxis examination is an ideal time to present oral hygiene instructions to the individual patient. Oral prophylaxis procedures are discussed in detail later in this volume. A thorough prophylaxis includes the following steps:

(1) Removal of plaque, exogenous stains, and calculus from the supra- and subgingival surfaces of the teeth.
(2) Polishing of the teeth.
(3) Application of an approved topical anticariogenic agent.

Along with the prophylaxis, you must give the patient preventive dentistry counseling. It is a good idea to have patients bring their toothbrushes and use their mouth to demonstrate cleansing techniques. This the patients to participate in the counseling sessions and permits the patient to immediately indicate his or her choice of toothbrush and brushing technique. Counsel the patients on the:

a. Proper technique needed for effective daily cleaning of oral hard and soft tissues.
b. Selection of a proper toothbrush.
c. Importance of daily use of dental floss to clean the proximal surfaces of the teeth.
d. Use of disclosing agents and fluoride dentifrices. (Emphasize that the fluoride dentifrice is only a minor aid to dental health. Total mouth health depends on physically removing the plaque with the brush and floss.)
e. Methods for cleaning prosthodontic appliances and maintaining the supporting tissues.
f. Diet, consistency of food, frequency of eating, and food habits for proper nutrition and dental health.

When you give preventive dentistry counseling, remember to vary your counseling because different individuals have different lifestyles. Their jobs and home habits also vary. In other words, you must personalize your counseling to meet the needs of your patient. For example, some people are office workers who can keep their toothbrush and dental floss in their desk. Others may work on the flightline and not have this convenience. You must direct each counseling session directly at the counselee and his or her particular circumstances.

Do not limit yourself when presenting oral hygiene ideas. The philosophy of one highly esteemed periodontist is to "take the bathroom boredom out of brushing." This philosophy has outstanding merit and can be applied to many of your counseling sessions. Encourage your patients to floss or brush without paste while watching television, or when held up in a traffic jam or at a stop light. Promote the idea of keeping a small floss dispenser and toothbrush in many convenient locations, such as in the desk drawer, workshop, living room, and the glove compartment of their automobile. Encourage patients to turn some of their idle time into a productive oral hygiene effort, and encourage them to have their families do the same. Families who brush and floss do not suffer tooth loss.

After you have completed the counseling session, be sure to make the appropriate entries on the SF 603, Health Record—Dental, under item 17, Services Rendered. Notations should be made to indicate the individual's progress in the control of dental plaque.

Dental Health Program for Food Handlers. Disease prevention for food handlers includes a dental examination and correction of disqualifying defects. Standards and procedures are contained in AFR 163–8, *Control of Foodborne Disease*. The director of base medical services examines food handlers whenever it is necessary, including periods before employment or following illnesses and during annual medical and dental examination periods. The responsibility for dental supervision of food handlers may be delegated to the examining dental officer. He or she will certify that dental qualifications have been met on SF 88, Report of Medical Examination, for military personnel and on SF 78, Certificate of Medical Examinations, for civilian personnel. Incipient caries or caries just entering the dentin does not prevent a person from being a food handler; however, advanced or severe caries is grounds for disqualification. Likewise, mild gingivitis is not a disqualifying factor, whereas pyrogenic or other dangerous organisms being massively discharged from chronically infected teeth or gums is reason enough for rejecting a food handler. There should be continuous coordination between the physical standards section and the base dental service to maintain firm control of food handlers.

Construction of Mouthguards. Participants in contact sports can receive fitted mouthguards from the dental service. Instruct recipients of mouthguards on how to clean and maintain them. The construction and maintenance of mouthguards are discussed later in this volume.

Exercises (620):

1. Place a check mark next to each element that is a part of the clinical phase of the preventive dentistry program:

   a. Dental prophylaxis.
   b. Fluoridation of water supplies.
   c. Plaque control management and preventive dentistry counseling.
   d. Periodic dental examination.
   e. Construction of mouthguards.
   f. Dental health program for food handlers.
   g. Dependent children program.
   h. Base newspaper articles.

2. What are the purposes of the periodic dental examination?

3. What information should be provided to each patient scheduled for plaque control management and preventive dentistry counseling?

4. Would incipient caries or mild gingivitis be a disqualifying factor for Air Force food handlers?

2-3. Community Health Phase

You, as the successful salesperson, must know your product, believe in the product, and be energetic and enthusiastic about it. Your product is preventive dentistry. The success of your program depends upon how good a salesperson you are.

621. State the intent of the community health phase of the health education program.

The community health phase of the USAF Preventive Dentistry Program is composed of those aspects of preventive dentistry intended to:

a. Publicize the program.
b. Educate the Air Force community.
c. Instruct small groups.
d. Effect procedures needed to improve the general dental health of the community.

This phase complements and reinforces the clinical phase by promoting good oral health habits in the Air Force community.

Fluoridation of the Water Supply. Controlled fluoridation of the communal water supply is an important dental public health measure. The appropriate conditions and the procedures for military water fluoridation programs are explained in AFR 161-44, *Management of the Drinking Water Surveillance Program*. The Air Force recommends adjustment of the fluoride content of water supplies at bases wherever fluoridation or defluoridation is justifiable and feasible. Fluoridation or defluoridation projects are limited to those bases where children are in residence and where approval has been obtained from Headquarters USAF.

Since most fluoridation projects have been completed in the Air Force, you are more concerned with monitoring than with establishing the projects. You should receive a report each month indicating how many parts per million of fluoride are present in the water supply. Your surveillance of these reports is necessary to assure that the equipment is working properly and that the correct concentration of fluoride is being maintained. You can obtain statistics concerning the fluoride content of the base water supply from either the Civil Engineering Water Division or the Military Public Section of the hospital.

The concentration of fluoride, if naturally present in drinking water, should not average more than the appropriate upper limits mentioned in volume 2, chapter 5. This table indicates the recommendations of the United States Public Health Service. Fluoride, in average concentration of more than twice the optimum values in table 2-1 warrants a rejection of the water supply. When you practice fluoridation (supplementing fluoride and drinking water), keep the average fluoride concentrations within the upper and lower limits shown in table 2-1. In most areas, a fluoride content of one part per million parts water is sufficient. However, as table 2-1 shows, this would not be true in areas having an extremely high or low average daily air temperature. Air temperature is considered a factor in determining proper fluoride content, because it directly relates to the water consumption rate of the local populations.

Oral Health Education. You believe in preventive dentistry, you know how to care for your mouth, you understand the necessity of professional dental care, and you believe in fluoridation of the communal water supply. Since you believe in all these things, it seems that if you told others they would believe also. Preventive density is not that easy; it takes more than telling. Maybe you should both show them and tell them. But this may not be enough, either. You must persuade them. Realize that you are asking people to change or modify their habits. Many of them have been cleaning their mouths the same way for years—just telling them that your way is better probably will not suffice. Some people are easy to sell; others are difficult. Your goal is to educate them through the judicious use of ethical publicity.

Material used in oral health education must be programmed in clinic budget planning. Avoid overt or implied endorsement of commercial products if you use material from dental manufacturers. Group education is most effective when repeated during the year. It should include the use of the following media: oral health displays, oral health posters, oral health literature handouts, military radio and television broadcasts, base newspaper articles, group health talks, and the Air Force Base Exchange.

Oral health displays. You can prepare simple and inexpensive displays with assistance from base education and training personnel who are responsible for training aids and graphics. Displays should be rotated periodically.

TABLE 2-1

FLUORIDATION CONTROL LIMITS

Annual average of maximum daily air temperature	Recommended control limits—fluoride concentration in mg/l Lower	Optimum	Upper
50.0 - 53.7	0.9	1.2	1.7
53.8 - 58.3	0.8	1.1	1.5
58.4 - 63.8	0.8	1.0	1.3
63.9 - 70.6	0.7	0.9	1.2
70.7 - 79.2	0.7	0.8	1.0
79.3 - 90.5	0.6	0.7	0.8

Oral health posters. Oral health posters may be procured through the American Dental Association or from other sources. Posters needed to support special projects may be prepared locally and must be coordinated with the proper officials (see AFR 5-1, *Air Force Publications Management Program*, and 6-1, *Policies, Procedures, and Standards for Production and Procurement of Air Force Printing, Duplicating, Copying, and Microform)*.

Oral health literature handouts. A variety of handouts can be procured from the American Dental Association. Handouts may also be prepared locally to support special projects. Copyright permission may be obtained from national professional organizations to reproduce their literature. Coordinate handouts designed for specific categories of patients, such as expectant mothers and parents of young children, with the medical service having primary or collateral responsibility for these patients.

Radio and television broadcasts. Where available, these media may be used to publicize base programs. The base information office can help you prepare script material. The base film library should have or can obtain films suitable for television viewing.

Base newspaper articles. A series of articles suitable for publishing in the base newspaper may be obtained from the American Dental Association. Articles should not be printed continually, but rather periodically for maximum effect. Articles and illustrations prepared locally must be carefully edited by your base dental surgeon. This is done to insure accuracy and to insure that the article presents a favorable image of the dental services.

Group health talks. Talks may be given in conjunction with commander's call, base orientation for newly assigned personnel, staff meetings, PTA, wives' club, schools, teen groups, scouts, and similar organizations. They may also be given for special groups such as prenatal clinics, personnel on flying status, and personnel on PCS movement orders. These group talks should be brief and limited to one subject, such as dental caries. They may be illustrated with slides or short motion pictures. The eventual objective, of course, is to acquaint the group with the overall dental health program.

Air Force Base Exchange. The availability of suitable home care items in the base exchange is essential for the success of the dental health program. The base exchange manager may assist in obtaining such items. Implied endorsement of particular brands *must be avoided!* Promotional emphasis should be directed toward the principal items required for good oral hygiene—namely, the toothbrush and unwaxed dental floss—and not toward supplemental aids, such as toothpastes. Many bases have base exchange advisory committees representing consumers. These committees frequently include hospital representatives and can influence the availability of items in the base exchange.

Exercises (621):

1. What is the intent of the community health phase of the preventive dentistry program?

2. To what military bases are fluoridation or defluoridation projects limited?

3. Why is air temperature considered a factor in determining the proper fluoride content of a water supply?

4. What should be your goal in the oral health education program?

5. When is group education most effective?

6. Where can you obtain assistance in the preparation of simple and inexpensive oral health displays?

7. Of what should you be careful if you use material supplied by dental manufacturers for oral health education?

8. What oral hygiene items sold by the base exchange should be given promotional emphasis?

2-4. Dependent Children Phase

The old saying "you can't teach an old dog new tricks" has some merit when it comes to preventive dentistry. It is sometimes difficult to get adult patients to modify their cleaning techniques. With children, it is often easier to teach the correct oral health techniques. The dependent children's program is a very important part of the U.S. Air Force Preventive Dentistry Program.

622. State the intent of the dependent children phase.

Dependent Children. The procedures for conducting the dependent children phase are contained in AFR 162–1, *Management and Administration of USAF Dental Activities*. This phase of the program is composed of those aspects of preventive dentistry that apply exclusively to dependent children. Each Air Force medical treatment facility having a dental capability and located in an area having a population of eligible children, will establish and operate a preventive dentistry program for dependent children. To be eligible for participation, the dependent child must meet the criteria outlined in AFR 168–9, *Uniform Services Health Benefits Program*. Participation in the dependent children program is voluntary.

Program Design. The program provides the following for each eligible child on an annual basis:

(1) A type 3 dental examination performed by a dental officer. The examiner will evaluate the patient's history and determine the presence of disease that would preclude the application of an anticariogenic agent. The examiner may also evaluate the patient for suitability of application of pit and fissure sealants. When routine dental care is not authorized, a treatment plan will not be initiated nor will the dental officer indicate the specific treatment required. It is permissible to recommend that the dependent child visit a family dentist for further evaluation and to relay the degree of urgency. Use AF Form 738, Children's Preventive Dentistry Program, as applicable. The dental technician should also perform an oral screening procedure prior to prophylaxis and call any unusual conditions to the attention of a dental officer.

(2) An oral prophylaxis.

(3) An oral hygiene or group demonstration may be conducted.

(4) Dental health education materials.

(5) Pit and fissure sealants may be applied, if staffing and workload permits.

(6) Oral hygiene aids, as indicated.

(7) A topical application of an anticariogenic agent to the teeth.

Routine Dental Care. Definite dental treatment will not be performed in connection with this program unless the patient is located where dental care for family members is authorized.

Air Force Dependent School Oral Health Programs. The dental service should conduct oral health programs among children through dependent school programs on a monthly basis throughout the school year. Plan these programs as an orientation and introduction to the clinical phase of the annual preventive dentistry program for dependent children. They may include the oral hygiene demonstrations and lectures required in the clinical phase, when it is practical to conduct these preliminary procedures in the school area rather than in the dental treatment facility. These programs must be coordinated with the base medical service, school authorities, and the school nurse.

National Children's Dental Health Month. Base dental services should take part in this nationally recognized program. Contact the American Dental Association well ahead of the February program for an informative planning packet. It is advisable to coordinate this preventive activity with the local dental society.

Exercises (622):

1. What regulation contains the procedures for conducting the dependent children phase of the U.S. Air Force Preventive Dentistry Program?

2. Why is a type 3 exam performed by a dental officer?

3. Under what condition are pit and fissure sealants applied?

4. When do dependent children receive definitive dental treatment?

5. With whom must the Air Force Dependent School Oral Health Program be coordinated?

2-5. Oral Communication

One of your important duties is to give group dental health talks. This, too, is a form of instruction. When you have an assignment to give a health talk, give a good, informative, helpful, and interesting talk. To do this, consider several things. First, who makes up the group? You may give talks in conjunction with commander's calls and base orientation for newly assigned personnel, and for other special groups such as prenatal clinics and personnel on flying status. Each group has different interests and different reasons for hearing your talk.

The first reason is probably that they have been told to be there. Therefore, you have the responsibility of gaining their interest and making them understand the importance of what you are saying. You do have a definite advantage at this point. You know that dental disease is a personal concern, that it is possible for each person to prevent dental disease in his or her mouth, and that your message will give him or her the knowledge to do this. Again, to sell a product, you must believe in it—and you do believe in your subject. You also should know who your audience is, and aim your message at that particular group. A group of OB patients will respond to a message that is obviously a part of their complete obstetrical care. When you receive your assignment, your subject is normally already selected. Usually, a file of dental health talks reduces the amount of time used in research, selecting objectives, and organization of material that is necessary.

623. List the three steps in organizing an oral health talk; state the advantages and disadvantages of each method of presentation; and specify the requirements for each part of a lesson plan.

Organizing an Oral Health Talk. Organization is the key to success for any presentation. In preparation for a big game, the competent coach spends hours in planning the plays and watching his or her team execute them. The effective speaker also devotes much thought and preparation to each presentation. You must be concerned with what you want to achieve and how to achieve it, such as establishing your objectives, selecting a method of presentation, and preparing the lesson plan.

Establishing objectives. The first step in developing a presentation is to establish the objectives. You must know exactly what you want your audience to gain before you can go any further. A presentation without objectives is like taking a trip without having determined a destination. You wander around aimlessly, and any benefits you receive are strictly accidental. You must decide what you expect your audience to learn as a result of your presentation. Once you have your objectives clearly in mind, you must select a method of presentation that will get your audience to that objective.

Methods of presentation. No one presentation method is suitable for all situations. No single method is flexible enough to meet the needs of every audience in every learning situation. You may choose from the lecture, guided discussion, demonstration, or the performance method. You may also combine methods, such as lecture–demonstration–performance, for your presentation.

Lecture. Lecture is the method of teaching in which the speaker presents all the facts, principles, and ideas orally. The success of this method depends solely on the speaker. The lecture may be conducted in either a formal or informal manner. The formal lecture does not allow audience participation. Normally, it is used when presenting information to large groups. In the informal lecture, the listeners are encouraged to ask questions if they do not understand. Also, the speaker questions his or her audience to see if he or she is being understood.

The lecture method has two definite advantages. First, it permits the speaker to present many ideas in one presentation. Second, it is a convenient method for presenting information to large groups. Some of the disadvantages are that it limits audience participation, makes it difficult to evaluate the audience's understanding, and does not hold the audience's attention as well as other methods.

Discussion. The *discussion* method of indoctrination is an orderly exchange of ideas with a goal in mind. Your job, as the discussion leader, is to ask questions, pose problems, and direct group participation. Your discussion group will answer questions and solve problems by "pooling" their ideas under your guidance. You can easily see that discussion for teaching use is purposeful and not merely a conversation about a subject. Used as a means of indoctrination, discussion is a well-led, orderly exchange of ideas leading to a predetermined conclusion.

Why discuss at all? Why should you take the time to develop objectives by questions when you can present the ideas yourself? The discussion method promotes group participation, stimulates effective thinking, allows you to correct misconceptions, and allows for individual expression. Its disadvantages are that it is time-consuming and that it is limited to people having enough basic knowledge to make the discussion worthwhile.

Demonstration. The *demonstration* method—"show and tell"—is the method in which you, the trainer, explain and show the audience exactly what you want them to perform. The method enhances your verbal explanation by showing visually what you are saying. The audience can see the skill being performed and hear your explanation at the same time. Thus, they can relate the principles and theories they have learned to a practical situation. Your demonstration sets the standard of performance that your audience must adhere to. Therefore, it is essential that you have a thorough knowledge of the skill, plus the ability to perform it without hesitation or error.

The demonstration method is useful, since it both tells and shows the audience how to perform. One disadvantage of this method is that it demands a greater skill on the part of the trainer. For instance, you must often perform the task in a position that is not normal, in order for the audience to see. Another disadvantage is that, since the audience does not perform during a demonstration, you cannot evaluate their skill. You should, however, ask questions during your demonstration. By asking questions such as "What principle is involved here?" and "Why must we do this first?," you can evaluate the audience's understanding of the task.

Performance. The *performance* method is the method that lets your audience practice and perform under close supervision. Normally, the performance method is used with the demonstration method. Its advantages are that it provides for individual guidance and evaluation of each person and it permits audience members to apply their knowledge to practical situations. The major disadvantages of the performance method are that it is time-consuming and it requires a higher trainer or student ratio than the other methods.

Each method of presentation has both advantages and disadvantages. You should select the method or combination of methods that best presents your lesson. The method must provide the means to get the students to the lesson objective. Once you have selected the presentation method, you are ready to prepare your lesson plan.

Lesson plans. The person who builds a house uses a blueprint, the orchestra leader uses sheet music, the TV repairer uses a schematic diagram, and the effective trainer uses a lesson plan. The lesson plan is a written plan for your presentation. Most speakers prefer to use a lesson plan with an outline format. The outline helps you to make sure that you present the talk in a planned, logical order without omitting any material. To organize the lesson effectively, first divide it into parts. A frequently recommended division breaks the lesson into an introduction, a body (or subject development), and a conclusion, as shown in figure 2-1.

The introduction should satisfy several needs. It should gain the audience's attention and focus it on the subject. Next, it should provide motivation for the audience to learn. Finally, it should present an overview of what is going to be covered during the presentation. The introduction prepares the audience for learning.

The body is the main part of the lesson. Here, you try to develop the subject matter in a manner that helps your audience achieve the desired learning. To do this, you must arrange the main points of your lesson so that each main point logically relates to the next main point. Usually, this relationship is developed in one of the follow ways: from past to present, simple to complex, known to the unknown, or from the most frequently used to the less frequently used. Listed under each main point in the lesson plan are the subordinate points.

Each subordinate point should support the main point that it is listed under. Also, it should lead logically into the next subordinate point. You should use meaningful transitions from one main point to another. These transitions keep the audience aware of where they have been and where they are going. Organizing a lesson so that the audience can grasp the logical relationship of ideas is not an easy task, but this type of organization is needed if your audience is to learn. Poorly organized material is of little or no value.

The conclusion should include three basic elements: a summary, a remotivation, and a closure. The effective summary retraces the important points of the presentation and relates them to the objective. This review and wrap-up of ideas reinforces the audience's learning and helps them retain what they have learned. Remotivation instills a desire to use what has been learned. The closure may consist of a quotation, statement, or any other device that will serve as a conclusion without reducing the audience's motivation.

Exercises (623):

1. List the three procedures required to establish an oral health talk.
2. Name two advantages of the lecture method.
3. What are the disadvantages of the lecture method?
4. What are the disadvantages of the discussion method?
5. What makes the demonstration method especially appealing?
6. State the advantages of the performance method.
7. What are the major disadvantages of the performance method?
8. What are the objectives of the introduction of a lesson plan?
9. How should you develop the subject matter in the body of a lesson plan?
10. What three elements should you include in the conclusion of a lesson plan?

624. State benefits of training films and graphics, and list some precautions for using chalkboards.

Training Aids. The effective use of training aids is not limited to any one phase of the instructing—learning process. You can use films, filmstrips, audiotape-

INTRODUCTION

Attention: Action or remarks which focus attention of audience on the speaker.

Overview:
1. Identify Dental Diseases
2. Identify Cause of These Diseases
3. Identify the Three Aids Necessary to Control the Cause of Dental Diseases

MOTIVATION: Tells how your lecture will benefit them. Gives audience reason to listen to speaker. Offers rewards for accomplishing plaque control. Be dynamic, forceful, and enthusiastic.

BODY
1. Identify Dental Diseases
   a. Tooth Decay
   b. Gum Disease

2. Identify Cause of These Diseases - Bacteria

3. Identify the Three Aids Necessary to Contol the Cause of Dental Disease
   a. Disclosing Agents
      (1) Purpose
      (2) Frequency Used
   b. Toothbrush
      (1) Handle
      (2) Head
         (a) Multi-tufted bristles
         (b) Small
         (c) Soft Bristles
         (d) All bristles the same length
   c. Floss (Stress necessity of use)

CONCLUSION

Summary:
1. Identify Dental Diseases
2. Identify Cause of These Diseases
3. Identify the Three Aids Necessary to Control the Cause of Dental Diseases

Remotivaltion: Tell why audience should have listened to you. Give them reasons for following your directions. Ask patients to make a personal commitment to themselves to follow your instructions. Make this step very strong.

Close: Say what you have to say and then shut up.

Figure 2-1. Lesson outline.

filmstrips, and slides to enhance your verbal explanation. You can often make group discussions more realistic and interesting by introducing pictures, charts, or graphs. Demonstrations can be vitalized by the use of portable equipment. Proper use of films, charts, mockups, and other training aids can save time, add interest, help students to learn, and make your job easier. The aids can do these things, but do they? They are only aids to instruction, not substitutes for instruction. They can give meaning to your instruction, but they cannot substitute for good teaching. Always use training aids to supplement your instruction rather than to replace a part of it. You should choose your instructional aids to fit each particular learning situation.

A training film can help you to clarify directions and explanations. If you use this aid, choose the film or filmstrip carefully. Be sure that it shows the ideas clearly. Preview the film so that you will be prepared to answer any questions. Prepare for the showing of the film by checking time and facilities and by giving an introductory explanation. Point out the important part of the film. A filmstrip requires more action on the part of the instructor than a film. Be prepared to make brief explanations with each frame. Have some type of checkup following the showing, if possible. Perhaps after a dental health talk, have a brief question-and-answer session. Other aids can also be effectively used in the same manner as a filmstrip.

You can use training graphics (charts, graphs, and diagrams) to present many pertinent facts, statistics, directions, and procedures. Select aids that are understandable; then add oral descriptions and explanations. Boards—chalkboards, magnetic boards, and flannel boards—can be skillfully used as training aids. The chalkboard is a most useful and flexible aid. However, if you use it, be certain to write large enough, plainly enough, and slowly enough. Do not clutter the whole board, do not erase too quickly, and do stand to the side so that the audience can see the board. Also, talk to the audience and not to the board.

Using and explaining the actual item about which you are teaching will yield better results. There are many items in your career field that can be a part of a demonstration or teaching experience. Realize that if a training aid does not contribute to the development of the audience's understanding, it is of no value. However, before you make this decision be sure that you are using it in accordance with the purpose for which it was designed and built. Especially remember that training aids are provided to help, not to replace, the instructor to achieve student development.

The equipment and materials you need for your instruction will vary with your presentation. A chalkboard is handy for many training sessions. If you need a movie or slide projector, you can usually check one out from the base film library. The Air Force stocks many films that may be suitable for your training program. Your squadron OJT monitor normally maintains current publications listing the available films. You can also write to the American Dental Association and the National Dairy Council for their catalogs. Many suppliers of dental materials also have films available on a loan basis. You must, of course, plan far enough in advance so that any training aids you need can be ordered and received before your presentation is scheduled.

Exercises (624):

1. How can training films enhance your presentation?

2. What precautions should you take when using a chalkboard?

3. How can you use training graphics?

624. State when to prepare training aids, how to use your voice and eyes, and where your presentation should lead.

Giving the Presentation. In the theater, the stage must be set before you raise the curtain; similarly, when you prepare to give an oral health talk, you must have the training area ready before you start the presentation. Have all the equipment and supplies set up ahead of the scheduled presentation time. This includes having your slides arranged and ready for showing, your movie projector loaded, and any other training aids and materials on hand and ready for use. Having to interrupt your presentation to gather and prepare equipment or supplies reflects inadequate planning. The better you have prepared your training area, the more comfortable you should be when you give your presentation.

Your voice and body movements make up the physical aspect of your presentation delivery. You should vary the pitch, rate, and force of your voice to emphasize points and to keep your voice interesting and not monotonous. Use natural hand and body gestures and try to avoid physical distractions such as coin jingling, pacing, and head scratching. Use direct eye contact with your audience. This shows them that you are interested in them and also lets you check for signs of doubt, confusion, or boredom. When you use the demonstration method, be sure that your audience can see your demonstration. If your talk has been well planned, the presentation should pose no problem. Your lesson plan should lead both you and your listeners to the desired objectives.

Throughout your speech, be aware that you are in a position to really help your listeners. You can take pride in knowing that you are presenting them with a method for having good dental health. This knowledge that you give them can prevent later suffering, save them money, improve their appearance, and (by maintaining their teeth and gums) help keep them in good general health. Remembering this gift you have for our listeners will enhance your self-esteem and cause you to like them. This results in a relaxed, pleasant you and a creditable speech.

Exercises (625):

1. When should you prepare all the equipment and supplies for a training session?

2. How can you keep your voice interesting during a presentation?

3. What do you gain by using direct eye contact?

4. Where should a well-planned presentation lead both you and your students?

2-6. Preparation for Oral Prophylaxis

The term "prophylaxis" means prevention of disease. When you apply its broadest interpretation to the oral cavity, it means all measures taken to prevent oral disease. For our purposes, we define oral prophylaxis as the clinical procedures that you perform for your patients. Our discussion will include evaluation of records, the seating of the patient, instrument examinations, and contraindications to prophylaxis. We will begin with the evaluation of the patient's dental health record.

626. Identify correct statements about the preparatory procedures for oral prophylaxis.

Evaluation of Records. *Before the patient enters the operatory*, evaluate his or her record for completeness. The folder should contain the patient's dental record, current X-rays, AF Form 696, Dental Patient Medical History, and other applicable forms discussed in Volume 3 of this course. Check his or her past medical history and past history of periodontal disease. Check the recommendations that were made during previous preventive dentistry counseling. If the patient has had radiographs taken since the previous oral prophylaxis, evaluate them for subgingival calculus and overhanging margins of restorations. The few minutes of evaluaton should tell you much about your patient. They help you evaluate your patient's home care habits and possibly the patient's attitude toward the care of his or her mouth. After you evaluate the record and perform all between-patient housekeeping, you are ready to seat the patient.

Seating the Patient. Seat the patient in the chair in a position that gives you the best view of the oral cavity. You can work while either seated or standing; however, studies have shown that the seated position is much less fatiguing. If you prefer to work standing, raise the chair so that the patient's mouth is approximately at your elbow. For the sitting position, adjust the stool and chair so that you are comfortable and your posture is correct. Your thighs should be parallel with the floor. Check the patient for comfort. Be sure that the chair's position is within the limits of operation. (The patient should not have to stretch to reach the cuspidor; nor should you have to lean over the patient to reach the water and air syringe.) If possible, position the bracket tray out of the patient's direct vision. Wash your hands in full view of the patient so that he or she will know that your hands are clean. Now you are ready to examine the patient's mouth.

Contraindications to Prophylaxis. Evaluate the medical history of dental patients before treatment begins. AF Form 696 must be completed for all patients. Use this form to find out whether there are any medical problems that can affect dental treatment. In addition to oral pathology, many medical problems are contraindications to prohylaxis as well as to other types of dental treatment. Many of these conditions require special precautions.

You, as the person performing the prophylaxis, are responsible for reviewing each patient's medical history. Any medical history, no matter how complete, is only as effective as the person who uses it. Discuss each question on the form. Develop all "yes" answers further as to what, when, where, how much, and how long. We will cover some of the areas on AF Form 696 that you should be especially aware of.

Heart conditions. If the patient has a history of angina pectoris, he or she probably carries his or her own nitroglycerin tablets. CAUTION: Nitroglycerin must be available at the time of treatment. If it is needed, place the tablet under the patient's tongue. You should avoid stress for patients who have suffered a coronary occlusion. Many of these patients require anticoagulants. Always check with the patient's physician. If the patient has high blood pressure (hypertension), avoid anything that can raise the blood pressure. Always check with the dental officer before treating these patients.

Diabetes mellitus (sugar diabetes). Patients with a history of diabetes are slow healers and are subject to infection. Antibiotics may be necessary. Check with the dental officer before treatment.

Kidney and liver disease. Ask these patients what, when, and how long? If there has been liver or kidney damage, local anesthetics or any other drugs should not be given. Check with the dental officer.

Rheumatic fever. Question these patients as to when, where, and how affected. Seventy-five to eighty percent of these patients have had some damage to the heart valves. Their treatment is the dentist's responsibility. Call the dentist's attention to any history of rheumatic fever. These patients should be premedicated with penicillin or other antibiotics.

Prolonged bleeding. Ask the patient the following questions about bleeding. Why? How much? How long? One episode or more than one? A slow bleeder or an oozer? These patients may be on anticoagulants. If the patient is on anticoagulants and if the dosage must be reduced for dental treatment, it must be done by a physician.

Reaction to local anesthetic. There are various types of reactions to local anesthetic. Toxic (poison) reactions are rare and usually result from a large dose. Allergic reactions to local anesthetic are also rare. Epinephrine in the anesthetic causes the veins to constrict, and this increases blood pressure. Local anesthetic is considered a very safe drug.

Allergies. If the patient has a history of allergies, find out what they are allergic to. Ask specifically about aspirin, novocaine, and penicillin. Find out what type of reaction they have had, and how long after adminstration it occurred. Record all information that the patient gives you. If the patient is allergic to penicillin or novocaine, be sure to make the appropriate entries (as explained in Volume 3) on his or her dental records.

Under the care of a physician. If the patient has been under the care of a physician during the past year, ask: for what, when, and where. Are they taking medication? What kind? Has he or she taken cortisone? Has the patient had any type of surgery during the past year? If the patient is being treated for a condition that can be a contraindication to prophylaxis, check with the dental officer. You may also want to check with the patient's physician before you render dental treatment.

Infections. For a patient with a history of recent infections, ask what infection, when, how long, and what treatment was received. If there is a history of existing infection or numerous infections the patient probably has lowered resistance, increased susceptibility, and slower postoperative recovery. Discuss the patient's history with the dental officer.

Complications following dental treatment. If the patient has experienced complications following dental treatment, find out what, when, and why. Try to uncover the dentistry-related complications, such as infection, nausea, fainting, and bleeding. Then relate the patient's past history to the complications you can expect in the future.

Condition of present health. Have the patient indicate the condition of his or her present health. If the patient has answered all previous questions with a "no," and then states that their present health condition is "fair" or "poor," ask further questions.

Instrument Examination. Before you begin any scaling procedures, make a thorough appraisal of the condition of the patient's mouth. This examination serves three purposes—it determines the needs of the patient, determines the sequence in which these needs must be met, and provides you with useful information for conducting the preventive dentistry counseling. Be sure that the dental light is properly adjusted for adequate viewing. Direct the beam as you move the patient's head.

This examination has two phases—observation of the entire oral mucosa, and examination of the teeth and gingival sulci. In the first phase, use the mouth mirror to retract the lips and look first for any open lesions. Then inspect the lips and move intra-orally to the labial, buccal, and vestibular mucosa. Examine the oral pharynx, retromolar area, maxillary tuberosity, soft palate, and hard palate. Pay particular attention to the tongue and the sublingual mucosa. In the second phase, examine the gingival sulci to determine their depth. Examine the teeth below the gingiva for the presence of subgingival calculus. Do this with a mouth mirror and explorer. Direct a gentle blast of air into the gingival sulcus to aid in the detection of subgingival calculus. Examine the teeth for stains, soft and hard deposits, defects, and dental caries. Disclosing tablets or liquid greatly help to detect the soft deposits on the teeth and are a valuable aid when you conduct your preventive dentistry counseling. Disclosing agents and preventive dentistry counseling will be discussed in other parts of this chapter.

Try to recognize deviations from the normal—especially those that relate to the oral prophylaxis technique. The first phase of your examination may reveal conditions that prohibit the continuation of the appointment. These conditions include lesions and manifestations of virus infection. Be alert for all of the types of oral pathology we discussed in Chapter 3 of Volume 2 of this course. Bring any condition that might be a contraindication to prophylaxis to the attention of the dental officer.

Disclosing Chemicals. Apply disclosing agents to the teeth before prophylaxis procedures. These agents reveal the presence of calculus deposits and stains. They are especially useful for coloring plaque, which is impossible to see without these agents. You also use disclosing chemicals to assist in patient education techniques. These agents color the deposit, stain, or plaque, but they do not color clean tooth surfaces. The disclosing tablets or liquid are an indispensable part of the recommended method of cleaning, discussed later in this chapter.

The coloring agent used in disclosing agents is a harmless red food coloring. The disclosing tablets are listed in the 6505 class in the *Federal Stock Catalog*. You may also use a 4-percent solution of basic fuchsin as a disclosing solution.

To use basic fuchsin, dry the teeth with compressed air, and apply the solution with a cotton applicator or a cotton pellet in cotton pliers. During the application of the solution, retract the patient's tongue, lips, and cheeks to provide access to the teeth and to avoid staining the oral mucosa. Instruct the patient to rinse thoroughly after the solution has been applied. The use of disclosing tablets is much more convenient. Ask the patient to chew the tablet and then swallow, or place three drops of liquid in the floor of the mouth. Inspect the teeth with a mouth mirror, using compressed air to move the papilla for a better view of the sulcus area. Give the patient a hand mirror to observe his or her own mouth while you are performing the examination. Now that you have finished your preparations, you are ready to begin the prophylactic procedure.

Exercises (626):

Indicate whether the following statements are true or false by circling the appropriate T or F. Explain any false statements.

T F 1. Before the patient enters the operatory, you should evaluate his or her dental records.

T F 2. Radiographs can aid you to locate subgingival calculus.

T F 3. If you work standing, raise the chair so that the patient's mouth is approximately at your mouth.

T F 4. After the patient is seated, wash your hands in full view of the patient.

T F 5. The cuspidor should be positioned well away from the patient.

T F 6. The purposes of the instrument examination are to determine the needs of the patient, determine the sequence in which these needs must be met, and to provide useful information for conducting the preventive dentistry counseling.

T F 7. The prophylaxis examination has two phases—observation of the entire oral mucosa and examination of the teeth and gingival sulci.

T F 8. A blast of air directed into the gingival sulcus aids in the detection of supragingival calculus.

T F 9. You should diagnose abnormalities and determine whether the patient should be treated.

T F 10. You should discuss all "no" answers on AF Form 696, Dental Patient Medical History, with the patient as to what, when, where, how much, and how long.

T F 11. If the patient has a history of angina pectoris, nitroglycerin must be available at the time of treatment.

T F 12. Patients with a history of rheumatic fever should be premedicated with an antibiotic drug if heart damage has been diagnosed by a physician.

T F 13. A patient with an existing infection or numerous past infections probably has a lowered resistance, and you should discuss such histories with a dental officer.

T F 14. Disclosing agents should be applied to the teeth before prophylaxis to reveal the presence of deposits and stains.

T F 15. To use disclosing tablets, have the patient chew the tablet and then rinse thoroughly.

2-7. Oral Prophylaxis Procedures

As you probably recall, we defined oral prophylaxis as the clinical procedures, related to the prevention of oral diseases, that you perform for the patient. In this section we will cover the various elements in oral prophylaxis.

627. State the purpose of tooth-scaling procedures and cite the primary factors in instrument selection.

Calculus Removal. Tooth scaling is used to remove calculus from the tooth surfaces. Basically, tooth scaling is mechanically fracturing the calculus deposits on the tooth's surface. It is relatively simple to remove large deposits of supragingival calculus, but removing small pieces of subgingival calculus in deep periodontal pockets is exceedingly difficult. Subgingival calculus can extend down the root of the tooth to the depth of the sulcus or pocket, and you must remove all of it in order to eliminate this source of irritation to the periodontium. When you remove the source of the irritation, the inflammatory response subsides. In the case of simple gingivitis, the gingiva usually heals completely and needs no further treatment. When deep periodontal pockets remain, pocket elimination procedures are usually indicated. Surgical eradication of pockets is done by a dental officer.

Scaling Instruments. Your choice of instruments is determined primarily by the amount of calculus present in the patient's mouth. If the patient has a large amount of supragingival calculus or heavy stain, start your scaling procedure with the ultrasonic prophylaxis unit. After you have removed the gross supragingival calculus, you must then use the various hand instruments to remove the subgingival calculus. If the patient has light to moderate deposits of supragingival calculus, you may choose to complete the entire procedure with the manual instruments. As we continue our discussion of these instruments, remember that the ultrasonic prophylaxis unit should be used to remove supragingival calculus only, while the hand instruments are effective for removing both supragingival and subgingival calculus.

Exercises (627):

1. What is the purpose of tooth-scaling procedures?

2. Why must all calculus be removed from the teeth?

3. What is the primary factor in instrument selection?

4. What instrument can be used only for large amounts of supragingival calculus?

5. Which instruments are effective in removing both supragingival and subgingival calculus?

628. Specify ways to determine when the ultrasonic prophylaxis unit is properly adjusted, how to apply the tip to remove calculus deposits, and how you should use selected instrument tips.

Ultrasonic Prophylaxis Unit. This dental instrument converts electric energy into sound waves. Electrical current sets a series of metal strips, called a stack, in the instrument handle into vibration. The length of these vibrations at the instrument tips is 1/1,000 of an inch. Tune the instrument to get the vibrations moving at their highest pitch—20,000 to 25,000 per vibrations minute. Adjust the water so that a fine mist flows off the tip of the instrument with some droplets. Approximately 35 cc of water per minute are needed to keep the tip of the instrument cool. To check the amount of water flowing on the tip, catch the water for 1 minute in a measuring vessel marked in cubic centimeters. Increase or decrease the water flow as necessary.

The handpiece assembly consists of a handpiece (which is the housing for the insert tips), a cable, and a cable plug. The open end of the handpiece is designed to accept the insert tips. To change inserts, pull out one and push in the replacement. Moisten the rubber O-ring located on the insert before inserting the tip into the assembly.

The ultrasonic prophylaxis unit is recommended only for the removal of supragingival calculus. The technique is similar to that used with other hand instruments except that you must use it in a continuously wet field. Apply the tip in a gentle, short, rapid, massagelike stroke. Overlap the strokes and repeat as necessary until all the deposits are removed. Keep the tip moving constantly while it is touching or nearly touching the teeth. A light touch produces satisfactory results. The various tips and their uses are follows:

a. Use the straight scaler (P–1) on interproximal spaces and anteriors. Use it from bicuspid to bicuspid. You may also use it on the occlusal surfaces.

b. Use the flat-hoe chisel scaler (P–3) to remove heavy deposits throughout the mouth.

c. Use the hatchet scaler (P–4) R&L paired instruments to remove calculus from the facial and lingual surfaces of the bicuspids and molars.

d. The small universal scaler (P–7) is a very sharp hook-type instrument. Use it to remove calculus and stain from very tight contacts.

e. The large universal scaler (P–8) is like the small universal in shape, but is a little larger. Its use is the same as the small universal.

f. The curette (P–10) is used in any area of the mouth.

Exercises (628):

1. If you are adjusting the vibration of the instrument tip, how can you tell that it is properly tuned?

2. How much water is needed to cool the instrument's tip?

3. What motion should you use when applying the instrument to the calculus deposits?

4. Which tip is used to remove heavy calculus deposits located throughout the mouth?

5. Where is the curette scaler (P–10) used?

629. Compare the effectiveness of curettes in scaling teeth with other periodontal scalers; tell why curettes are paired; and explain the uses of certain other scaling and examining instruments.

Periodontal Scaling Instruments. Curettes are recommended instruments for removing fine deposits of subgingival calculus. Investigations have shown that hand scaling with curettes is superior to scaling with other instruments. These instruments have proven to be less traumatic to hard structures, cementum, and supporting structures of the teeth. All the curettes discussed in this section can be placed subgingival to the base of the sulcus or pocket. With them you can accomplish subgingival scaling with minimal discomfort to the patient and, if the instruments are handled correctly, with minimal damage to their soft tissues and teeth.

Each instrument has a working end or blade, a shank, and a handle. The shank connects the blade to the handle. The curettes are double-ended so that you can use one end of the instrument to scale the mesial of a tooth and use the other end of the instrument to scale the distal of the same tooth. The shank of each posterior instrument is angled, making it easier to reach the surfaces of the posterior teeth. The following instruments make an ideal set:

a. The *Gracey* No. 3 and No. 4 are paired, double-ended instruments. Use this instrument on anterior teeth. Keep the handle in the same direction as the long axis of the tooth.

b. The *Gracey* No. 11 and No. 12 are paired, double-ended instruments. This instrument is referred to as the "universal." You can use it anywhere in the mouth.

c. The *McCall* No. 13 and No. 14 are double-ended instruments. Use these instruments for scaling bicuspids.

d. The *McCall* No. 17 and No. 18 are double-ended instruments. Use these instruments for scaling molars.

e. The *U–15–33*, , although a sickle-type rather than a curette-type scaler, is particularly effective for scaling anterior teeth. Used for supragingival calculus only.

Other Periodontal Instruments. In addition to the scaling instruments already mentioned, three other instruments are needed to give you a complete instrument setup for each patient. The first of these is the periodontal probe:

a. Periodontal probe. Use the periodontal probe to determine the presence, form, and depth of periodontal pockets. The shank of the probe forms an angle between the working end and the handle. The probe is very thin and can be inserted easily to the depth of the gingival sulcus or pocket. The working end is scored at millimeter intervals for pocket measurement. Some probes have millimeter marks for every millimeter from 1 through 10. Others have marks for every millimeter from 1 through 3, marks for every 2 millimeters from 3 through 7, and marks for every millimeter from 7 through 10. If the depth of the pocket is over 5 millimeters, count back from 10 to get your measurement.

b. Explorer. Use the explorer for oral inspection and other oral prophylaxis procedures. The No. 23 explorer is recommended for this purpose. It is a sickle-shaped instrument, making it most useful for posterior teeth. The explorer is a useful aid in detecting subgingival calculus.

c. Mouth mirror. The mouth mirror provides visibility of tooth surfaces in areas of the mouth that are beyond the range of direct vision. The mouth mirror is also useful as a retractor of the patient's tongue and cheeks. The reflecting surfaces are available in three types: plane, front surface, and magnifying.

Avoid causing discomfort to the patient when you are using the mouth mirror. Do not use excessive pressure on the handle or shank against the patient's lips or the corner of the mouth. Do not press the edge of the mirror into the gingiva. Since some teeth are sensitive to metal, do not touch the teeth with the mirror when you are inserting it into, or removing it from, the mouth. Hold the mirror with a modified pen grasp.

Exercises (629):

1. Name the advantages of scaling with curettes in comparison to other scaling instruments.

2. Why are curettes paired?

3. The *Gracey* No. 3 and No. 4 are used to scale which teeth?

4. Which teeth would you scale with the *McCall* No. 13 and No. 14?

5. Which instruments are called the universal scalers and can be used anywhere in the mouth?

6. What are the purposes of the periodontal probe?

7. What purpose, other than providing visibility, does the mouth mirror serve?

630. Name the three instrument grasps and cite the proper procedures for establishing a finger rest.

Instrument Grasps. A correct instrument grasp is an important part of instrumentation. It has a direct bearing upon your ability to manipulate instruments. There are three instrument grasps that you may use during oral prophylaxis procedures:

a. Pen grasp. With the pen grasp, hold the instrument the way you would hold a pen when writing. This grasp is shown in figure 2-2. Activate the instrument with a rolling motion of the forearm and wrist.

b. Modified pen grasp. With the modified pen grasp, hold the instrument in basically the same way as in the pen grasp, except that you place the fleshy part of your middle finger on the shank of the instrument. This grasp is shown in figure 2-3.

c. Palm grasp. In the palm grasp, place the instrument across the first phalange of your fingers. Then flex your fingers over the handle into the palm of your hand. Leave your thumb free. The palm grasp is shown in figure 2-4. This grasp is useful when you need exceptional force.

d. Finger rest. Use a finger rest to maintain control of the instrument. You should use a finger rest in the same arch as the working area and as close to the working area as possible. In the modified pen grasp, the third or ring finger is always used as a finger rest. This finger can rest on the teeth, the gingiva, another finger, or a combination of these. Do not use soft movable tissue for a finger rest. When you are holding the instrument in the pen grasp, use your third finger as the finger rest. When you are using the palm grasp, use your thumb for the finger rest. The same

Figure 2–2. Pen grasp.

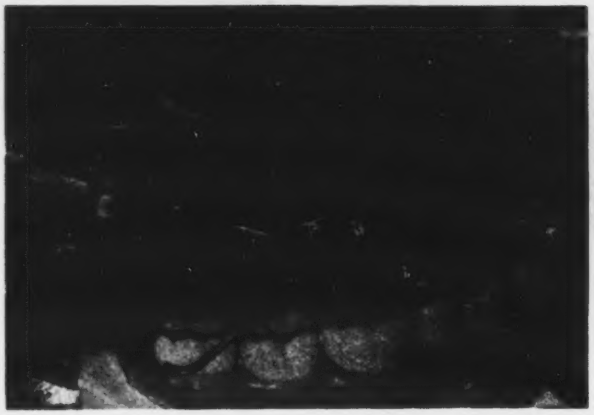


Figure 2–3. Modified pen grasp.

Figure 2–4. Palm grasp.

finger that is used as a finger rest also acts as a fulcrum, the pivot around which the necessary force to remove the calculus can be exerted.

Exercises (630):

1. What are the three instrument grasps?

2. What instrument grasp is useful when you need exceptional force?

3. Which finger should you use as a finger rest when you are holding the instrument in the pen grasp?

4. The thumb is a finger rest for which instrument grasp?

631. Specify whether given statements about periodontal scaling procedures are correct or incorrect.

Systematizing the Periodontal Scaling Procedure. You should approach each patient with a specific plan of treatment. This plan will, or course, vary with the individual patient's needs. Your work on most patients who have regular prophylactic treatment and practice adequate oral hygiene can usually be completed in one appointment. Patients who have neglected their oral health, such as those with periodontitis, may require several appointments. Regardless of whether the scaling can be completed in one sitting or in several sittings, you should approach the scaling task systematically.

If the patient has gross supragingival calculus deposits, you should remove them first. These deposits are easy to locate and are usually easy to remove. The ultrasonic prophylaxis unit is particularly useful for performing the gross scaling. As you begin your hand scaling with the curettes, you should divide the mount into segments. The most widely used segmentation method is to divide the mouth into quadrants. Each quadrant begins with a central incisor and extends posteriorly to include the third molar. When you are scaling patients with advanced periodontitis, you may be able to scale only one quadrant during the first appointment and one quadrant during each subsequent appointment. When more than one appointment is needed, reevaluate the areas previously scaled during each subsequent appointment. You may find calculus deposits that were left and must be removed at this time. If the entire scaling is to be done during one appointment, you should still complete an entire quadrant before you begin the next quadrant. If you skip haphazardly from one area of the mouth to another, you will miss some areas and waste time. As you begin your work within each quadrant, try to use each instrument in all the areas indicated by its design before changing to another instrument.

Exercises (631):

Indicate whether the following statements are true (T) or false (F) by circling the appropriate T or F. Explain any false answers.

T F Systematizing the periodontal scaling procedure means that the same treatment plan is used for each patient.

T F If the patient has gross calculus deposits, periodontal curettes are usually the first instrument you use in the scaling routine.

T F Before beginning your hand scaling, you should divide the mouth into segments. The most widely used segmentation is dividing the mouth into quadrants.

T F If the entire scaling is to be done in one appointment, complete an entire quadrant before you begin the next quadrant.

T F When scaling the teeth, you should remove the deposits from all the aspects of one tooth before you start to scale another.

632. Cite the operating position of the technician during oral prophylaxis.

Positions of the Technician. After seating the patient, adjust the chair so that both you and the patient are comfortable. Working from a position where your working area is slightly lower than your heart keeps your hand and arm from getting tired. You may work from either a standing or sitting position. Most technicians prefer a sitting position, since they find they are less tired at the end of the work day. Operating from the seated position has another advantage. It allows you to view most areas without having to look in the mouth mirror. Most technicians find that the scaling procedure can be performed faster and more efficiently if they have a direct view of the operating area. If you do choose to stand, distribute your body weight equally on both legs. Whether you stand or sit, maintain a good posture by keeping your back straight.

Exercises (632):

1. To prevent your hand and arm from tiring, you should work from a position where the working area is _____ than your _____ .

2. Working from the seated position is less tiring and lets you view most oral structures without having to use the _____ _____ .

3. If you work from the standing position, you should distribute your _______ equally on both ________ .

4. Whether you stand or sit, maintain a ______ ______ by keeping your ______ ______ .

633. Cite the actions that both directly and indirectly show thoughtfulness to the patient.

Thoughtfulness to the Patient. As you perform the prophylaxis procedure, remember that you are working on a living, breathing human being. You must do your work in a manner that does not irritate the patient. Your job is not to chastise the patient for their past neglect, but to *rehabilitate* and *educate them toward improved oral hygiene*. Be as gentle as possible during the scaling procedure so that you do not injure the tooth or its surrounding tissues.

Frequently irrigate the scaling site to prevent particles of calculus from becoming implanted in the gingival tissues. Be careful when you retract a tissue with the mouth mirror. Too vigorous a retraction can be extremely uncomfortable to the patient.

Periodontal scalings performed with sharp curettes produce smoother root surfaces than do other scaling methods. You cannot do a good job unless you use sharp instruments. Dull instruments not only do an inadequate job but are a waste of time and effort. In addition, dull instruments are hard to control. They can easily slip off the scaling surface and lacerate or puncture the patient's lips, cheeks, or palate. So, after each patient, check your instruments and sharpen them, if necessary.

As you place your instruments on the bracket table, place them in the order you are going to use them. For instance, if you are going to scale the anterior area first, place the curette you will need in the first position on the bracket table. This prevents you from having to search through your instrument setup to find the one you need. Color coding tape can also help you find the instrument you need quickly. Patients can easily lose confidence in a technician who is frequently changing instruments in an effort to find the right one to scale a particular area. No matter how well organized your instrument setup is, occasionally you will pick up the wrong instrument. When this occurs, it is a good idea to go ahead and briefly use the instrument rather than show your error to the patient by immediately changing instruments. You must consistently do everything in your power to gain and maintain your patient's confidence.

While you are scaling, you will occasionally need to remove calculus and debris from the working end of your instrument. You can do this in several ways. You can place a dappen dish containing hydrogen peroxide on the bracket table and simply dip the instrument tip into the solution. Or you can wipe the instrument on a gauze sponge that is either attached to the towel chain or hold in your nonscaling hand. Avoid wiping the instrument directly on the patient's towel because blood and debris from your hands or the instrument can stain the patient's clothing.

Exercises (633):

1. Why should you not irritate the patient psychologically?

2. Why should you be as gentle as possible during the scaling procedure?

3. How can you prevent calculus particles from becoming implanted in the gingival tissues?

4. Why should you be careful when you are retracting a tissue with the mouth mirror?

5. What are three reasons for using sharp instruments for the scaling procedure?

6. How can you code instruments to make them easier to identify?

7. Why should you make an effort not to change instruments frequently?

8. Why should you clean your instrument tip on a gauze sponge or in a dappen dish containing hydrogen peroxide rather than wipe it on the patient's towel?

634. List and compare the various methods employed to locate calculus.

Locating the Calculus. The actual scaling process begins after you have located the deposits of calculus. Drying the teeth with a stream of warm air helps to expose supragingival calculus. Disclosing chemicals can also help you locate these deposits. You can see some subgingival deposits if you direct the air stream into the gingival sulcus.

Pay particular attention to areas of gingival inflammation. Deposits in the periodontal pocket cannot usually be seen. To locate these deposits, you must depend on your sense of touch. By inserting an explorer or a fine curette into the pocket area, you can usually feel the characteristically rough texture of the calculus deposits. The areas that are the most difficult to locate and remove calculus deposits from are the concave grooves leading into the furcation areas of multirooted teeth. These areas are located on the root surface just below the cervix. Figure 2-5 illustrates a typical furcation groove.

Exercises (634):

1. What chemicals can help you locate supragingival calculus?

2. Into what area should you direct a stream of air to locate subgingival calculus?

3. What must you depend upon to locate calculus deposits in the periodontal pocket?

4. What is the chief characteristic of the calculus deposits in periodontal pockets?

5. In what area is it most difficult to locate and remove calculus deposits?

635. Given statements about the scaling strokes that should be used in selected situations, identify each as correct or incorrect.

Instrumentation. After you have located the calculus deposits, you are ready to perform the instrumentation necessary to remove them. There are two basic scaling strokes. The first is the vertical stroke which parallels the long axis of the tooth. Use the vertical stroke to remove calculus from the proximal surfaces of the teeth. The other stroke is the horizontal stroke which parallels the cervical line. Use this stroke to remove deposits from the facial and lingual surfaces of the teeth. The vertical stroke is considered the safest scaling stroke because the instrument's cutting edge does not come in contact with the epithelial attachment. Do not use the horizontal stroke where probe measurements show that the sulcus depth is uneven, as the curette will be dragged into the epithelial attachment at the higher areas. Even where the sulcus depth is uniform, be extremely careful when using the horizontal stroke. The vertical and horizontal strokes are illustrated in figure 2-6. You must often alter these strokes slightly to an oblique or diagonal direction in order to scale all the tooth's surfaces.

There are three distinct phases in each scaling stroke: the exploratory phase, the positioning phase, and the working phase. Refer to figure 2-7 as we discuss these phases. Figure 2-7,A, shows the exploratory phase of the stroke. Before beginning this stroke, establish your finger rest on a dry, firm tooth structure as close as possible to the tooth being scaled. Gently insert the curette under the gingival margin. Grasp the curette lightly and move it down toward the base of the gingival sulcus. Keep the curette's tip in light contact with the calculus or tooth surface and continue the downward movement until you feel the tension of the soft tissue attachment.

When you reach the base of the sulcus, you are ready for the positioning phase. This phase is illustrated in figure 2-7,B. Position the blade at the apical aspect of the deposit so that it forms a 45° to 90° angle with the tooth. If the angle is

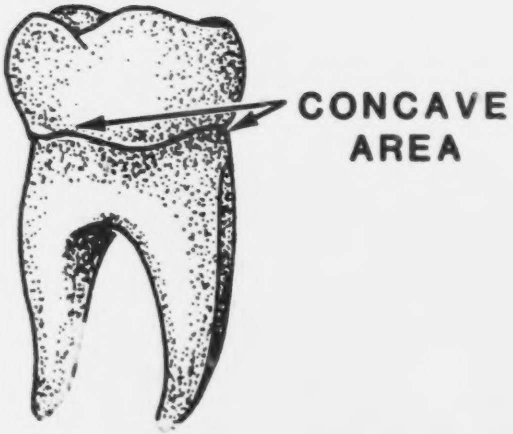


Figure 2-5. Furcation grooves.

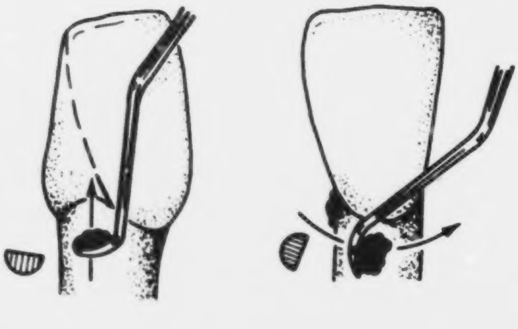


Figure 2-6. Basic scaling stroke.

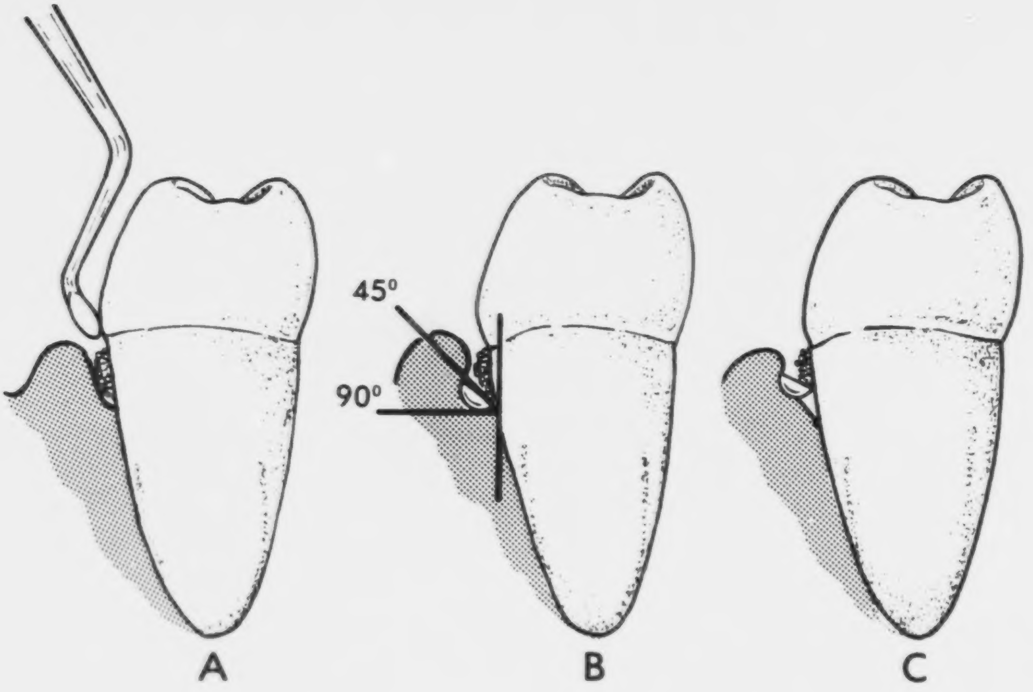


Figure 2-7. Phases of the vertical stroke.

less than 45°. your working stroke will probably slip over the deposits. If it is more than 90 , you are in danger of gouging the root surface. After you have positioned the instrument properly, you are ready to begin the working phase of the stroke.

Before starting the working phase of the stroke, tighten your grip on the instrument. Use your hand, wrist, and arm to activate the instrument. Avoid scaling with independent finger movements as this technique is extremely fatiguing. Your working stroke should be short, controlled, decisive, and directed in a manner to protect the tissues from trauma. With the short stroke, you can maintain control of the instrument and adapt the cutting edge to variations in the tooth's surface. Always keep as much of the working blade on the tooth as possible, not just the point of the blade. The exact length of the stroke depends on the height of the deposits. During the working stroke, you should slightly increase the pressure on the fulcrum to balance the pressure of the instrument on the tooth. The working stroke is shown in figure 2-7,C.

Try to work within the boundaries of the pocket or sulcus to eliminate the need for the repeated withdrawal and reinsertion of the curette. This practice not only saves time but also reduces the number of times that the instrument must pass over the tooth's highly sensitive neck and gingival margin, where the enamel and cementum is thinnest. Whenever possible, remove the whole thickness of calculus in one piece. Never remove calculus by shaving it in layers. Shaving often leaves a thin layer of calculus, which is difficult to distinguish from the tooth's surface. This thin layer can serve as a nucleus for new plaque and calculus formations. Frequently irrigate the pocket and sulcus areas to prevent the implantation of calculus deposits into the underlying tissues. Figures 2-8 through 2-19 illustrate the suggested instrument and finger rest positions for scaling different areas of the mouth. Even without the aid of a mouth mirror, you can scale the mandibular incisors on all surfaces except the distal-lingual surfaces of the lower right anteriors and the mesiolingual of the lower left anteriors. You can obtain direct vision by changing your position from in front of the patient to behind the patient. Instrument placement and finger rests are illustrated in figures 2-20 through 2-23. After you have completed the scaling procedure, you are ready to polish the teeth.

Exercises (635):

Indicate whether the following statements concerning instrumentation are true (T) or false (F) by circling the T or F. Explain any false statements.

T F 1. The horizontal scaling stroke should be used in areas where the sulcus depth is uneven.

Figure 2-8. Maxillary right posterior, facial and proximal position.

Figure 2-11. Maxillary anterior lingual position.

Figure 2-9. Maxillary right posterior, lingual position.

Figure 2-12. Maxillary left posterior, facial and proximal position.

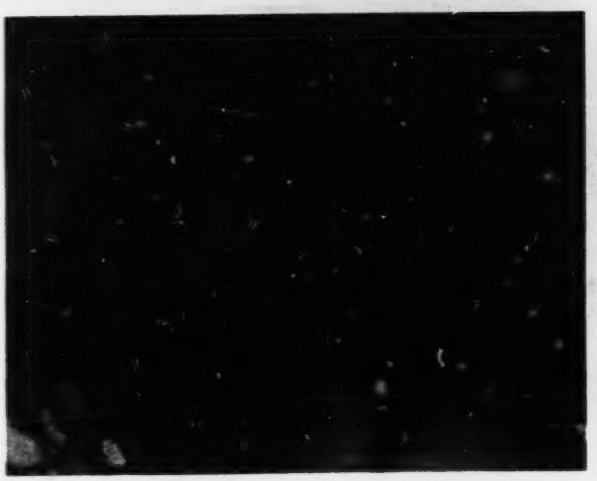


Figure 2-10. Maxillary anterior, facial proximal position.

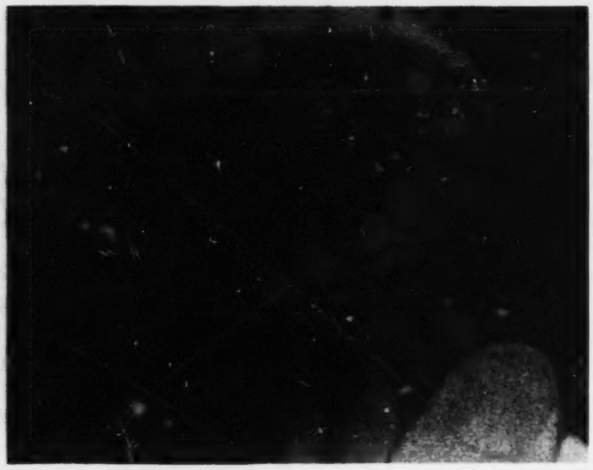


Figure 2-13. Maxillary left posterior, lingual position.

Figure 2-14. Mandibular left posterior, facial and proximal position.

Figure 2-15. Mandibular left posterior, lingual position.

Figure 2-16. Mandibular anterior, facial and proximal position.

Figure 2-17. Mandibular anterior, lingual position.

Figure 2-18. Mandibular right posterior, facial and proximal position.

Figure 2-19. Mandibular right posterior, lingual position.

Figure 2-20. Pen grasp mandibular anterior finger rest.

Figure 2-23. Modified pen grasp, mandibular anterior, lingual position.

Figure 2-21. Modified pen grasp, mandibular anterior finger rest.

Figure 2-22. Modified pen grasp, mandibular cuspid finger rest.

T F 2. The vertical scaling stroke parallels the long axis of the tooth and is usually used to remove calculus from the proximal surface of the teeth.

T F 3. The scaling stroke that may be used to remove calculus from the facial and lingual surfaces of the teeth is the horizontal stroke.

T F 4. The first phase of the scaling stroke is the positioning phase.

T F 5. Before beginning the scaling stroke, you should establish a finger rest on a soft-tissue structure.

T F 6. In the first phase of the scaling stroke, you should insert the curette under the gingival margin and, keeping the curette's tip against the tooth's surface, move it down until you feel the tension of the soft tissue attachment.

T F 7. Before beginning the working phase of the stroke, position the instrument blade so that it forms a 45° to 90 angle with the tooth.

T F 8. Try to use independent finger movements when scaling to avoid becoming fatigued.

T F 9. Your working stroke should be short, controlled, decisive, and directed in a manner to protect the tissues from trauma.

10. During the working stroke, slightly increase the pressure on the fulcrum to balance the pressure of the instrument on the tooth.

11. When you scale the teeth, you should make an effort to reduce the number of times the instrument must pass over the neck of the tooth.

12. The best way to eliminate calculus is to shave it off layer by layer.

636. State the purpose of polishing the teeth, and designate the materials and procedures involved in the process.

Polishing Teeth and Restorations. After you have completed the scaling procedures, you must polish the teeth to remove stains and plaque. Gross deposits of stain should be removed with hand instruments. Zircate or some other fine abrasive agent is best for polishing. Studies using the electron microscope have shown that the enamel of teeth polished with a fine abrasive agent is much smoother than when it is polished with flour of pumice. The secondary cuticle (a factor in the formation and attachment of plaque and calculus) does not reattach as fast when the teeth are polished with zircate.

Apply the polishing agent to the teeth with a rubber cup attached to a prophylaxis handpiece or to a conventional speed contra-angle handpiece. You may use a mounted bristle brush on the occlusal surfaces. Use slow speed and light pressure to reduce the amount of heat generated. Be careful not to damage the soft tissues. Keep the cup moving over the tooth surfaces to reduce heat. Use a systematic routine to make sure that you polish all areas.

The rotating cup or brush can sling polishing material out of the patient's mouth. You should always wear protective glasses and mask, and drape to protect the patient's clothing.

You may not be able to reach all of the interproximal areas with the polishing cup. To polish these areas, place the polishing agent in the facial and lingual embrasures and carry it into the interproximal space with waxed dental floss or dental tape. Waxed dental floss and tape are used for this procedure, since the abrasive effect of the polishing agent destroys the strands of unwaxed floss. However, the patient should be instructed to use unwaxed floss for his or her home care because the fibers separate and plaque is removed more easily from the tooth surfaces. Remember that the primary purpose of polishing is to produce a smooth surface. Plaque and calculus do not form as quickly on smoothly polished tooth surfaces. It is essential that you polish all surfaces.

Polish amalgam restorations with a rubber polishing cup filled with an approved agent or tin oxide. Run the handpiece slowly, using light pressure. If you discover an overhanging restoration, be sure to call it to the attention of a dental officer or make a note of this finding in the remarks section of the patient's dental record. Overhanging restorations are a prime source of gingival irritation, and they should be promptly corrected.

Exercises (636):

1. What is the purpose of polishing the teeth?

2. What should you use to remove gross deposits of stain?

3. Name two agents that may be mixed with an abrasive agent to make the polishing paste.

4. How should you apply the polishing agent to the teeth?

5. Name three ways to reduce the heat generated during the polishing procedure.

6. Why should you wear protective glasses when you are polishing a patient's teeth?

7. What type of dental floss should you use in conjunction with an abrasive agent to polish the proximal tooth surfaces?

8. Why should you recommend unwaxed floss for the patient's home care program?

9. What should you do if you notice an overhanging restoration when you are polishing the teeth? Why?

637. Cite the use of stannous fluoride as an anticariogenic agent.

Anticariogenic Agents. After you complete the scaling and polishing procedures, you should administer a topical application of an approved anticariogenic agent to the teeth. In the United States Air Force Dental Health Program, topical stannous fluoride is currently recommended. A 30-second-per-quadrant application of a 8 percent aqueous solution is preferred. The 30-second method described below is a meticulous procedure.

Prepare the application by dissolving 80 gm SnF_2 (stannous fluoride) in approximately 500 ml distilled water in a 620 ml volumetric flask. Add 40 ml glycerin and mix well. Bring the flask to volume with distilled water and add 1 ml flavoring oil, such as oil of peppermint, oil of spearmint, oil of anise, or oil of orange. Mix well. Allow to stand at room temperature for 2 to 3 hours and decant any excess oil and dregs. Store the mixture in a tightly sealed plastic bottle. The identification legend for the bottle should be: "Stannous Fluoride—16 percent bulk solution (Date)." The prescription legend should read: "For use in dental clinic under professional supervision. Not to be dispensed to patient for self-use."

The following directions are for a topical application of fluoride via the prophylaxis paste. Thorough scaling must precede any topical fluoride application. Mix the stock solution with an abrasive agent to prepare fresh prophylaxis paste. A fluid, slurry mix yields the highest percentage of stannous fluoride, and a thick paste yields the lowest percentage of stannous fluoride. The fluoride is applied as the teeth are polished.

Thorough scaling and polishing must precede topical applications of aqueous solutions. For these, dilute a small portion of bulk solution with an equal volume of distilled water in a dappen dish to provide an 8 percent solution. Isolate the teeth with cotton rolls, dry the teeth with compressed air, and keep the teeth moist with the 8 percent solution throughout a 30-second-per-quadrant period. Advise the patient not to eat, drink, or rinse his or her mouth for 30 minutes following the treatment. Repeated applications are recommended at 6- to 12-month intervals. CAUTION: Do not apply fluoride if the patient's gingiva is extremely irritated. Certain chemical factors in the fluoride compound can increase the irritation. Reschedule such patients so that you can evaluate the therapy. If the healing is satisfactory at the time of the evaluation, you should then apply the fluoride.

Exercises (637):

1. The amount of fluoride needed to mix a 16 percent stock solution of fluoride in a 620 ml volumetric flask is _____ _____ .

2. Oil of peppermint, spearmint, anise, or orange is added to the fluoride mixture to serve as a _________ .

3. Allow freshly mixed fluoride solution to stand at room temperature for ___________ to ___________ hours; then decant any excess oils.

4. The prescription legend on the 16-percent bulk solution of stannous fluoride should read: "For use in dental clinic under _______ _______ . Not to be dispensed to patient for __________ _________ ."

5. Topical applications of fluoride via the prophylaxis paste must be preceded by a thorough _________ .

6. To prepare for a topical application of fluoride in an aqueous solution, you should dilute the 16-percent solution with an ______ volume of _________ _____ .

7. The application of stannous fluoride in aqueous solution is done by ________ and __________ the teeth and then moistening them with the fluoride for ________ _________ per quadrant.

8. The patient should be advised not to _______ , ______ , or _____ _____ _____ for 30 minutes following treatment.

9. Repeated applications of fluoride are recommended at _________ to ___________ month intervals.

2-8. Fabricating Impressions, Casts, and Mouthguards

You must have an impression of a patient's mouth before you can make a working cast. You must have a cast before you can make any type of prosthesis for a patient. Since you will take impressions for mouthguards, you need to know how to prepare the material and how to take the impression. How to make stone casts and fabricate mouthguards are included in your duties. These areas are discussed in this section.

638. Name the material used for taking impressions, list some of the procedures for pouring impressions, and cite the reasons for these procedures.

Impression Material. You will use hydrocolloid impression material to take impressions of a patient's

490

mouth. This material is an elastic type that returns to its original shape after being stretched during its removal from undercut areas. Hydrocolloids do not adhere to other substances; therefore, when you are working with this material, you must use rimlock trays so that the mixture will remain in the tray after it has gelled. Although there are two types of hydrocolloid impression materials (reversible and irreversible), you will be concerned only with the alginate type (irreversible).

The alginate-type gels by chemical action. Once the gelation process begins, it is irreversible. You cannot soften the material after it has solidified, nor can you reuse or sterilize it. An alginate is a salt of alginic acid extracted from seaweed. Alginate-type hydrocolloids come in a powder form, either in bulk or in measured portions packaged in foil envelopes. Store the powder in a cool place and keep the bulk form in a tightly closed container to protect it from contamination and to prevent it from absorbing moisture.

Since this impression material is influenced by shrinkage, expansion, strain, and stress, you should pour the cast as soon as the impression is removed from the mouth. If for some reason you cannot pour the cast immediately, you can briefly store the impression in a humidor in which the relative humidity is 100 percent. The strength of the material can be affected if you use either too little or too much water with the powder. Be certain to measure the impression material and water according to the direction of the manufacturer for the proper water-powder ratio. Temperature affects the setting time. Heat accelerates the set; cold retards it.

Exercises (638):

1. What impression material is used to take impressions of a patient's mouth?

2. Why do you need rimlock trays when working with hydrocolloid impression material?

3. Which of the two types of hydrocolloid impression material will you use?

4. Why should you pour the cast as soon as the impression is removed from the mouth?

5. What quality of the impression material is affected if you use either too little or too much water with the powder?

6. What affects the setting time of the impression material?

7. How do heat and cold affect the setting time of the impression material?

639. In the preparation of impression material, cite the equipment used and its desirable features.

Equipment. Before preparing the material, have a rimlock tray available. Be sure that the tray you select is large enough. When you insert it into a patient's mouth, it should allow from one-eighth to one-fourth inch of space around all surfaces of the teeth and range from one-eighth to one-fourth inch distal of the maxillary tuberosity. You need a mixing bowl in which to mix the material. Using a rubber bowl that is fairly flexible makes mixing easier. Also, you probably will prefer a wide and slightly flexible spatula. Ideally, the temperature of all three items should range from 65° F to 72° F. If the items are warm, they can decrease the setting time of the impression even though you have been careful to have the correct water temperature.

Exercises (639):

1. What are the three equipment items needed for the preparation of the impression material?

2. What type of rubber bowl makes the mixing procedure easier?

3. Which type of spatula is usually preferred for mixing the impression material?

4. How should the rimlock tray fit when you insert it into the patient's mouth?

640. Cite the procedures for preparing the impression material.

Preparation of Impression Material. Before measuring your materials, rinse the rubber bowl with cool, distilled water (65° F to 72° F). Remove all the water from the bowl. Measure the proper amount of water and pour it into the bowl. You should have preweighted powder available in small plastic containers; if not, carefully weigh the powder. Measure the alginate material in according to the directions of the manufacturer. Now pour the *powder* into the *water*. Spatulate by vigorously and thoroughly mixing so that you fully incorporate all of the powder into the mixture. This prevents lumps in the mix and makes for a faster mix. Turn the bowl on its side and rotate the bowl, mixing against the sides. Clean the sides as you turn the bowl, using a folding motion. Continue this until the mix is smooth and creamy and has a somewhat shiny surface. Keep in mind that the maximum mixing time is normally 60 seconds. When the material is mixed to your satisfaction, you are ready to load the tray.

Exercises (640):

1. What should you do before measuring the materials?

2. How should you measure the alginate material?

3. Should you pour the powder into the water or should you pour the water into the powder?

4. While you are mixing, clean the sides of the rubber bowl, with a ______ motion.

5. What is normally the maximum mixing time?

641. State procedures for loading the tray and fabricating the impression.

Loading the Tray. The roll of metal around the top of a rimlock tray mechanically retains the impression material. Your first step is to lock the impression material under the rimlock; that is, see that the material is under the metal roll all around the top of the tray. Then fill the remainder of the tray. Take some material on your fingertip and do a bit of "finger painting" on the patient's teeth. Cover the occlusal surfaces of the posterior teeth and the facial surface of the anteriors. Now insert the tray.

Fabricating the Impression. Insert the tray in a sideways, circular motion, straightening it inside the mouth. Have the patient lean forward to prevent material from running down the throat and ask him or her to hold the corners of a paper towel to catch saliva overflow. Make the first contact over the maxillary tuberosity and the posterior teeth. Next, apply pressure over the anterior teeth, seating the tray so that its flange is under the upper lip. Stretch the patient's cheeks out and down over the flange while you hold the tray in the palate with your middle finger. Allow the material to set before you attempt to remove the tray.

The first step in removing the tray is to insert your finger facially and push down at the third molar. This breaks the mucous seal at the posteriors. Now, pull the tray down with your finger. Remove the tray with the same sideways motion you used to insert it. Use a sharp instrument to remove any excess impression material from the tray. You now have in your hand an alginate impression, which is an accurate negative reproduction of the dental arch of your patient.

The next step is to prepare the impression for pouring a positive reproduction—the working cast. Handle the impression with care as you work with it to keep from distorting it. The purpose for cleaning the impression is to remove mucus and saliva and to help insure good surface detail. Sprinkle plaster on the impression or dip it in a thin plaster-water solution to remove saliva. Then rinse the impression under cool tapwater. Remove excess moisture, but *never* completely dehydrate an impression. Shake the moisture off. Do not use an air gun became you may distort the material.

There is a certain amount of flexibility in *how* you pour an impression, but pour all impressions immediately. Change occurs in the impression material when it leaves the mouth. The amount of change depends upon the time lapse between taking and pouring the impression. You should already have the hydrocal available for making the working cast.

Exercises (641):

1. The first step in loading the tray is to lock the __________ __________ under the rimlock.

2. When you apply impression material to the patient's teeth, cover the __________ surfaces of the posterior teeth and the __________ surfaces of the anterior teeth.

3. Insert the tray in a __________ , __________ motion, __________ it inside the mouth.

4. After the tray is in the mouth, make the first contact over the maxillary __________ and the ______ ______ .

5. The first step in removing the tray is to insert your finger __________ and push down at the third molar. This breaks the __________ seal at the posteriors.

6. After removing the impression from the mouth, cleanse it to remove __________ and __________ and to help insure good __________ detail.

7. You should not use an air gun to remove moisture as it may __________ the material.

642. Cite procedures used in fabricating stone casts.

Fabricating Stone Casts. The proper manipulation of hydrocal is vital to the quality of the set mass. The rubber bowl and spatula should be at normal room temperature. First, measure out 30 cc of distilled water (68° F. to 72° F.) and pour it into the rubber bowl. Next, weigh out 100 grams of powder and sift it into the water below the water level. Incorporate all of the powder from the sides of the bowl and spatulate the mix thoroughly but avoid whipping it. This causes air bubbles. Mix for 30 to 60 seconds and eliminate the air bubbles by frequently jarring the bowl.

There are many ways to pour a cast. The two-step method, described here is the most propular. Hold the impression tray with the impression in it so that the handle is against the vibrator. Fill the tray from one terminal molar area so that the stone goes from one tooth to the next, around the arch, pushing the air and water out ahead of the stone. After you have filled all of the spaces, invert the tray and vibrate the excess stone out of the tray to eliminate air bubbles on the occlusal surfaces of the teeth. With the tray right side up, fill with stone—again using the same technique. After filling the tray, leave the top of the stone rough, but do not let the rough portion extend too high or the patty for the base will have to be too big. Allow the mixture to set with the tray in a horizontal position. The initial set takes from 7 to 15 minutes. It is essential that the first mix of stone has hardened before you invert the impression to make a base.

You make the stone patty for the base in the same way that you make the cast. Shape it to make a ½-inch patty and place it on a slab. Invert the hardened model onto the patty and shape the patty around the model. The final set takes approximately 45 minutes. Figure 2-24 illustrates the two-step method. If you exercise all possible caution when you handle the impression but are careless with the master cast, all of your time and effort is wasted.

Work as neatly as possible. Sometimes you can take shortcuts, especially when you are in a hurry. There are, however, some things that you must remember to do to make a good cast. Trim the excess stone from the tray. This makes the removal of the tray easier. Do not hurry and force or rock the tray. You may break off some teeth. Gently but firmly remove the impression from the cast. Suppose some impression material is clinging to the cast. You know it should not stay there. If you are in a hurry, you may be tempted to hold the cast under running tapwater and brush it with a denture brush until it is clean. If you do this, you make two mistakes. First, you must never brush a cast. If some impression material remains on the cast, use an instrument and carefully remove the material. A denture brush scratches a cast, and you do not want it marred. Second, you must not rinse a cast under running tapwater because it erodes stone. If you must rinse the cast, use slurry water. Slurry water is a mixture of partially dissolved hydrocal and water, usually obtained from the combination of hydrocal grindings and water emitted by the model trimmer. While it seems that a small amount of tapwater could hurt very little, by the time the water touches the cast several times the combined small bits of erosion can make a significant change.

Use a model trimmer and trim the base of the cast so that it is almost round. This makes it easier to work with as you fabricate a mouthguard.

Exercises (642):

In the following statements indicate which are true (T) or false (F) by circling the T or F. Explain any false answers.

T F 1. Proper manipulation of hydrocal is vital to the quality of the set mass.

T F 2. The rubber bowl and spatula should be at normal room temperature before you measure the materials.

T F 3. You should spatulate the mix for 30 to 60 seconds and eliminate air bubbles by frequently jarring the bowl.

T F 4. Holding the tray on the vibrator, begin filling the tray with hydrocal from the incisor area so that the stone flows over all of the teeth.

T F 5. After you have filled the tray, allow the mixture to set by placing the tray in a vertical position.

T F 6. The initial set of the stone takes from 4 to 7 minutes.

T F 7. It is essential that you permit the first mix of stone to harden before inverting the impression to make a base.

T F 8. You make the stone patty for the base in the same way that you make the cast.

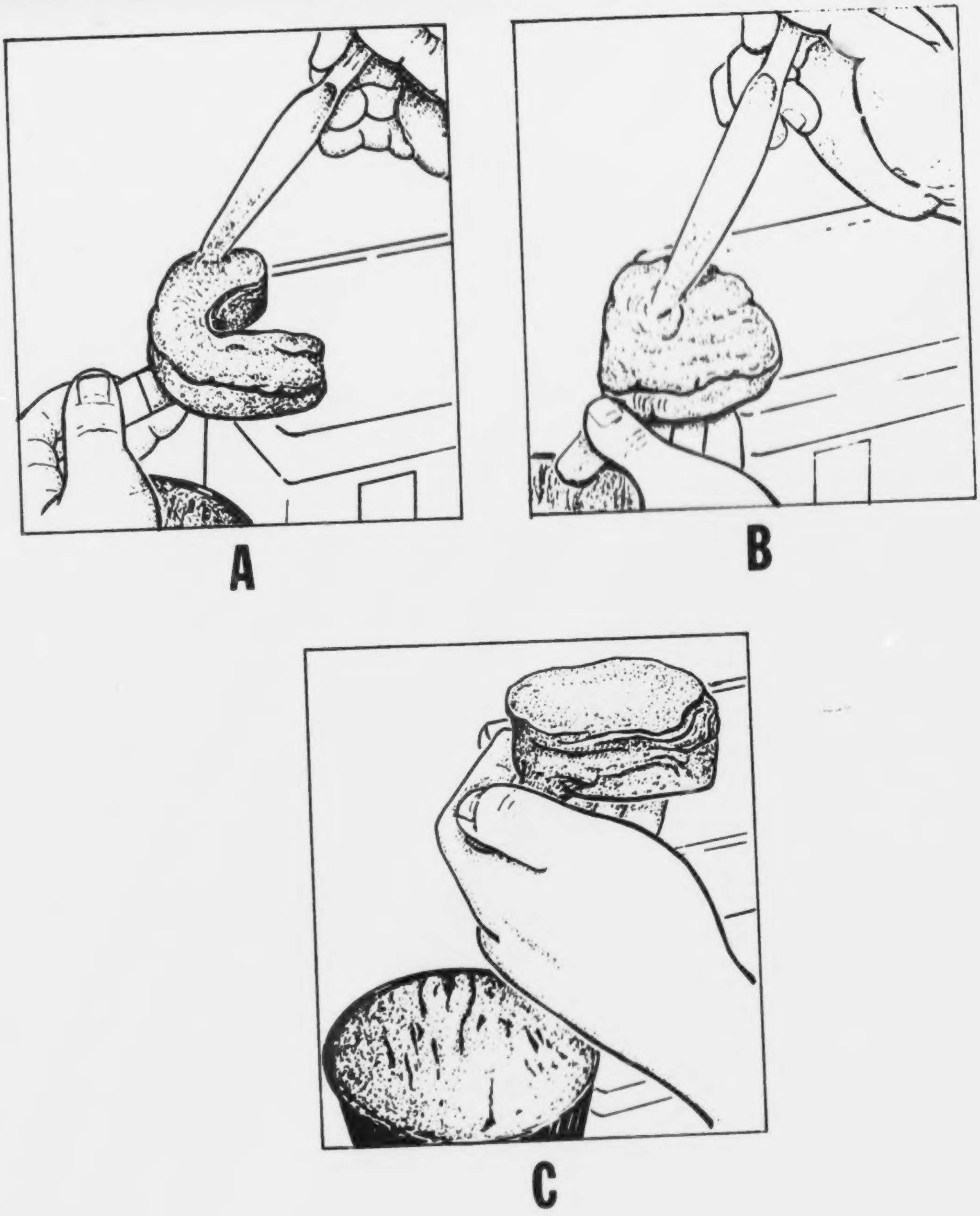


Figure 2–24. Two-step method.

T F 9. Shape the patty so that it is 1 inch thick and place it on a slab.

T F 10. Invert the patty onto the hardened model and allow it to set for 30 minutes.

T F 11. When you remove the tray for the model, do not rock or force the tray; if you do, you may break off some teeth.

T F 12. If you need to rinse the cast, you must use cool. running tapwater.

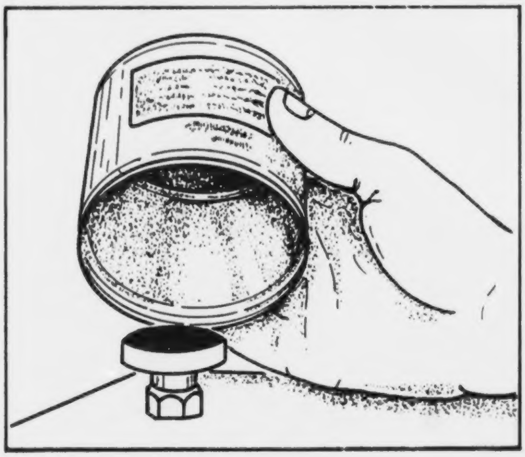


Figure 2-25. Adapting the vacutron.

643. Cite important features in the fabrication of mouthguards.

Fabricating Mouthguards. You will find this task most pleasurable because most of your patients who need mouthguards are athletes—in the "pee-wee" leagues. In the group of little people, owning a mouthguard can be a status symbol.

Before the actual mouthguard construction, you must prepare the working cast. First, trim the working cast so that you can pull the mouthguard material down over all of the teeth and into the muco-buccal fold. Either the dental officer or you must then use a roach carver to score the cast horizontally at the point where the soft tissue meets the attached gingiva. This provides a line by which you later trim the mouthguard.

Equipment and supplies. With the working cast prepared, you are ready to begin the mouthguard construction. Naturally, your first task will be to gather the equipment and supplies needed for the fabrication process. There are units designed specifically for mouthguard construction, but they are not normally found in most dental clinics. If your clinic happens to have this equipment, follow the instructions of the manufacturer. On the other hand, if your clinic is like most clinics, you will have to modify some of your present laboratory equipment. Our discussion is based on an acceptable method of fabricating mouthguards, using modified equipment.

Most of the equipment and materials you will need can be found in the dental laboratory. In addition to the working cast, you will need a mouthguard material called plastic strip, plus a pair of scissors to cut the plastic strip; a pan of water; a unit to heat the water from 180° to 200° F. (the compound heater or boilout tank can be used for this purpose); an instrument to handle the hot material; and a unit to provide a vacuum. You can easily adapt the vacutron (Jelenko's) for mouthguard fabrication by perforating the bottom of an anesthetic can and inverting the can over the knob on the suction plate (fig. 2-25). You can adapt a tank-type vacuum cleaner by inverting the can over the open end of the vacuum hose.

You will also need a piece of equipment to adapt the plastic strip over the working cast. You can make this piece of equipment by placing a piece of heavy rubber dam over the open end of an alginate can or a coffee can and securing it with a strand of ligature wire. As with the anesthesia can, you must perforate the bottom of the alginate can (see fig. 2-26). After the mouthguard material has been adapted to the cast, you must remove the excess material and smooth any rough edges. To perform this task you need an alcohol torch, a laboratory knife or scissors, and a lathe equipped with an arbor band.

Adapting the mouthguard. By examining the working cast, you can determine how large a piece of mouthguard material is needed. A square of this material is normally large enough for two adult mouthguards. Use the scissors to cut the material to the approximate size. For adult mouthguards cut the material diagonally to make two triangles. Then trim the material into shape by cutting off the corners of the triangle you are going to use. You may need the second triangle later for another mouthguard. When you have the rough form cut out, place it in hot water (180° F. to 200° F.). The material will take on a cloudy appearance when it is placed in the water. When this cloudiness vanishes and the material appears clear, it is ready to be adapted to the cast.

Place the working cast on top of the anesthesia can and position the mouthguard material on the top of the cast see fig. 2-27. Some technicians prefer to presoak the cast in slurry water. Turn on your vacuum device and apply an even pressure to the mouthguard material by stretching the rubber dam over the material and the cast (fig. 2-28). (NOTE: Coat the rubber dam with silicon lubricant to keep it from sticking to the mouthguard material.) Apply the pressure for approximately 30 seconds. Next, remove the rubber dam and make the final material adaptation to the floor and sides of the model with your fingers.

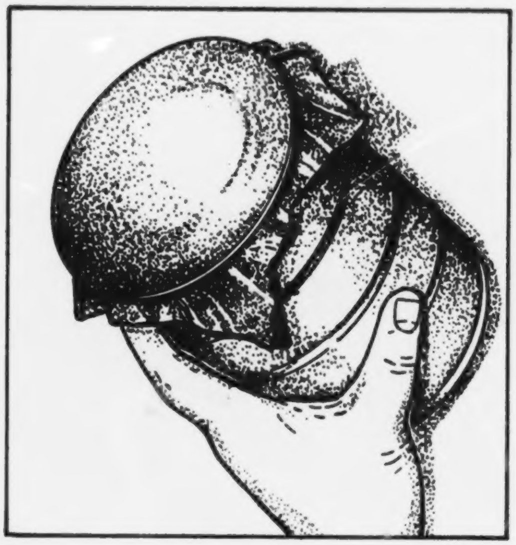


Figure 2-26. Adaption equipment.

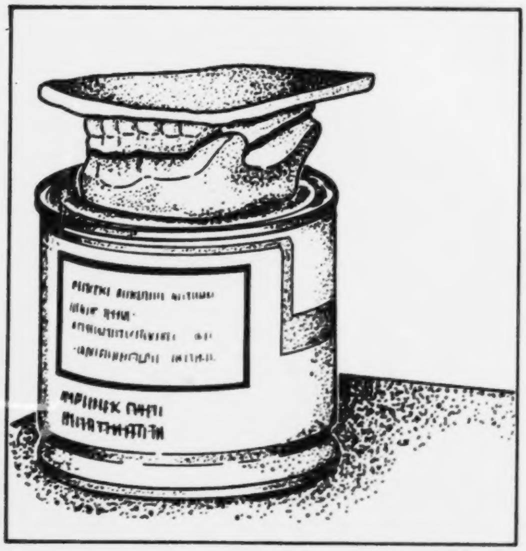


Figure 2-27. Positioning the material.

Using the rubber dam as described has two advantages. First, it uses only half a sheet of material for the normal adult cast, whereas many other methods use an entire sheet. This, or course, results in a substantial cost reduction. Second, the material is evenly adapted over the biting surfaces of the teeth. An even adaption is important because it prevents thin spots, which can be bitten through easily when the patient is engaged in a contact sport. When your final adaptation is complete, turn the vacuum unit OFF and allow the material to cool.

The next step is to follow your design and trim away the excess material. You may use either scissors or a laboratory knife for this trimming. Make the final trim with an arbor band and then remove any rough areas caused by the arbor band by lightly touching the trimmed edge with the flame of an alcohol torch. This leaves a glossy, smooth edge. The mouthguard is now finished and ready to be tried in the mouth of its young owner. Naturally, any necessary adjustment can be made, but it is unusual for a mouthguard to need additional work.

Exercises (643):

1. How is the working cast prepared for mouthguard construction?

2. List the items needed to adapt the mouthguard material to the cast.

3. After the mouthguard material has been adapted to the cast, what must you do?

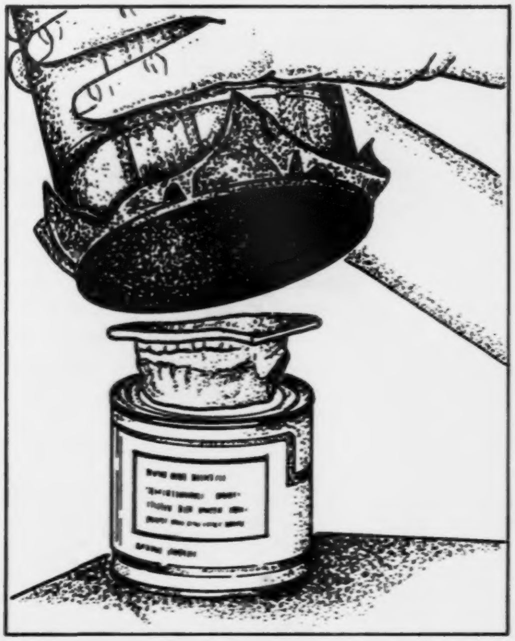


Figure 2-28. Adapting the material.

4. Name the items needed to remove the excess material and smooth the mouthguard.

5. After you have placed the mouthguard material in the hot water, how can you tell if it is ready for adaptation to the cast?

6. What are two advantages of using the rubber dam over the mouthguard material?

2-9. Oral Health Education

One of your most important duties when working in the preventive dentistry section is to educate your patients in improved oral hygiene. Before you began this CDC, your earlier training in the dental career field provided you with a much greater knowledge of oral hygiene than your patients possess. Now your knowledge should be even more advanced. Think back to your knowledge of oral hygiene and your habits before you entered this career field. If you are like the average assistant, there has been a notable change in your oral hygiene behavior.

You are not expected to pass on to a patient everything you know, but you are expected to motivate him or her toward improved oral hygiene. In your presentations, remember that each patient has his or her own needs. For some patients your counseling should be simple; for others it can be more complex. Though some patients absorb only superficial oral health information, others ask questions that test your knowledge. In each case, your counseling can have a more profound impact on the patient's future oral health than any physical treatment you have given them.

The needs of your patients must be met on an individual basis. You are already able to conduct effective preventive dentistry counseling because you have a thorough knowledge of oral communication techniques, oral pathology, nutrition, and anticariogenic agents. In this section, we will add acceptable brushing and flossing techniques to your realm of knowledge. We will also discuss the counseling atmosphere and review some items to include in your counseling sessions. Some of the areas were covered earlier in volume 2, but a review is appropriate as we attempt to synthesize that information to enable you to give an effective counseling.

644. Identify the bacteria found in the mouth by definition, description, and types.

Oral Flora. "Oral flora" are the bacteria normally found in the mouth. Over a hundred types of bacteria are found in the mouth alone. For the purpose of this CDC, "bacterium" is defined as "any microorganism." "Bacteria" is the plural form for "bacterium." Each bacterium is a tiny bit of living jelly surrounded by a clear, thin covering called a membrane.

Some bacteria are branched and sheathed like plants, while others have locomotive organs, similar to animals. Thus, in the scheme of life they occupy an intermediary position between animals and plants, with some properties of both. Bacteria are usually thought of as something that makes people sick, but many kinds of bacteria are so useful that we could not live without them.

Exercises (644):

1. What is meant by the term "oral flora"?

2. How is the term "bacterium" defined for the purpose of this volume?

3. Briefly describe a bacterium.

4. How can bacteria be compared with animals and plants?

645. Identify the categories of bacteria.

Categories of Bacteria. There are several different ways to categorize bacteria. Some, termed "saprophytes," derive their nourishment from dead or decaying matter. These organisms for the most part do not cause disease. Other bacteria are categorized as "parasites." These organisms live on, or in, other living organisms, deriving their nourishment at the expense of the host.

Parasitic bacteria that live in or on a host but do not cause serious damage are termed "nonpathogens." Those that severely damage their host by destroying the host's tissues or causing serious infections are "pathogens." A pathogen that causes infection so severe that it results in permanent damage or death of the host is termed a "virulent" pathogen. Nonvirulent pathogens damage the host, but the damage is usually not permanent and rarely results in the death of the host, unless other underlying debilitating (weakening) conditions are present.

Bacteria are further categorized into three groups based upon their need for oxygen. "Anaerobic" bacteria grow only in the absence of oxygen and, in the human mouth, are usually deep in the sulcus. "Aerobic" bacteria grow only in the presence of oxygen; that is, they must have oxygen to live. "Facultative" bacteria are the microorganisms that can live under either aerobic or anaerobic conditions. These can be found deep in the sulcus or on the tongue. Each of these types is found in infectious areas. Most bacteria cannot live in direct sunshine.

Bacteria are also distinguished as being either "Gram-negative" or "Gram-positive." These terms refer to the staining method devised by Gram in 1884. When using a phase microscope, you have no need for Gram stain. Although you will probably not use this staining method, you should know in general what it means because it is frequently used. Stain is useful in the differentiation of bacteria. A smear is prepared and air-dried, and then stained with a primary violet stain, followed in order by a mordant (fixing agent), a decolorizer, and a counterstain. Some bacteria have the ability to retain the violet dye after being treated with decolorizer and exhibit a pronounced purple or blue color throughout the process. These bacteria are called Gram-positive. The bacteria that lose their purple or blue color after decolorization and become a pinkish red are called Gram-negative.

Exercises (645):

1. Bacteria that derive their nourishment from dead or decaying matter are termed ________ .

2. Bacteria categorized as __________ live on or in other organisms, deriving their nourishment at the expense of the living host.

3. A pathogen that causes infection so severe that the host is permanently damaged is called a __________ pathogen.

4. __________ bacteria grow only in the absence of oxygen and, in the human mouth, are usually deep in the ________ .

5. Gram-positive bacteria have the ability to __________ the violet dye after being treated with decolorizer.

646. Specify the five forms of oral bacteria according to their physiological characteristics.

Forms of Bacteria. Bacteria have many different shapes and forms (fig. 2-29). We have reduced the number of oral bacteria (normal flora) to five forms for our discussion here. Though this material is only a superficial explanation of all the bacteria found in the oral cavity, it will be useful to you in motivating your patients toward better oral health.

Cocci (KOCK-sigh) (coccus-singular). The cocci forms are usually Gram-positive, nonmotile, and facultative. They are spherical or oval-shaped, and are about 1 micron (1/1,000 mm) in diameter. The cocci forms exist singly or in aggregate (in chains or in colonies, with clusters of varied shapes). You should be able to recognize the following types of cocci:

a. Streptococci (strep-to-KOK-sigh), the most common of all the oral bacteria, is Gram-positive and facultative. Figure 2-29 shows that it grows in chains. It does not usually cause disease unless it settles on abnormal heart valves causing subacute bacterial endocarditis; in urinary tracts; or in the meninges (men-IN-jeez), one of the membranes enveloping the brain and spinal cord. Varieties of strepococci have recently been implicated in the caries process.

b. Staphylococci (STAF-i-lo-kok-sigh) are Gram-positive, facultative, and grown in clusters. They are nonmotile and are most often found on human epidermal surfaces. They cause osteomyelitis, boils, abscesses, ulcers, and several types of food poisoning. However, they also produce various enzymes that are necessary to maintain some of the normal body functions.

c. Neisseria (ny-SE-ree-ah) are Gram-positive cocci, usually occurring in pairs in the mouth and respiratory tract. They are nonmotile and aerobic, and are arranged in pairs with their adjacent walls compressed, as shown in figure 2-29. The Neisseria group is composed primarily of two parasitic types of bacteria—the gonococci (which cause gonorrhea) and the meningococci (which cause meningitis).

d. Veillonella (VAY-yon-el-ah) are Gram-positive cocci. They are strict anaerobes that physically resemble the Neisseria. It is not clear whether these organisms should be called pathogens or not. They have frequently been isolated from abscesses on teeth.

Bacilli (bah-SIL-eye). These are a form of bacteria that you will see much of in your clinic. They are rod-shaped, about 3 or 4 microns long, and 1 micron in diameter. They can be sporeforming (Gram-positive) and nonsporeforming (Gram-negative). Some are motile; others nonmotile. They are either aerobic, anaerobic, or facultative. There are several types of bacilli, but the most important are the fusiform types. Fusiforms are Gram-negative, anaerobic bacilli, which inhabit the gingival sulcus and increase to large numbers when ANUG (acute necrotizing ulcerative gingivitis) is present. They are very susceptible to antibiotics.

Spirilla (spi-RIL-ah). The most common spirillum of the oral flora is the vibrio (VIB-ree-o). These are short, bent rods (fig. 2-29). Each has a single polar flagellum (fla-JELL-um) tail. They are either Gram-positive or Gram-negative and are anaerobic. They are found in cases of severe diseases, in deep gingival sulci, and in pockets. They are extremely motile. This little comma-shaped organism helps you to motivate your patient toward better oral hygiene, because it will flip across the microscope's field of vision like a speedboat, spinning and turning in every direction.

Filamentous (fil-ah-MEN-tus) branching organisms. These are Gram-positive, anaerobic, nonmotile, branching organisms. They are found around the teeth, in plaque, and in calculus. You will probably see two types of filamentous organisms. An illustration of filamentous branching organisms is shown in figure 2-29.

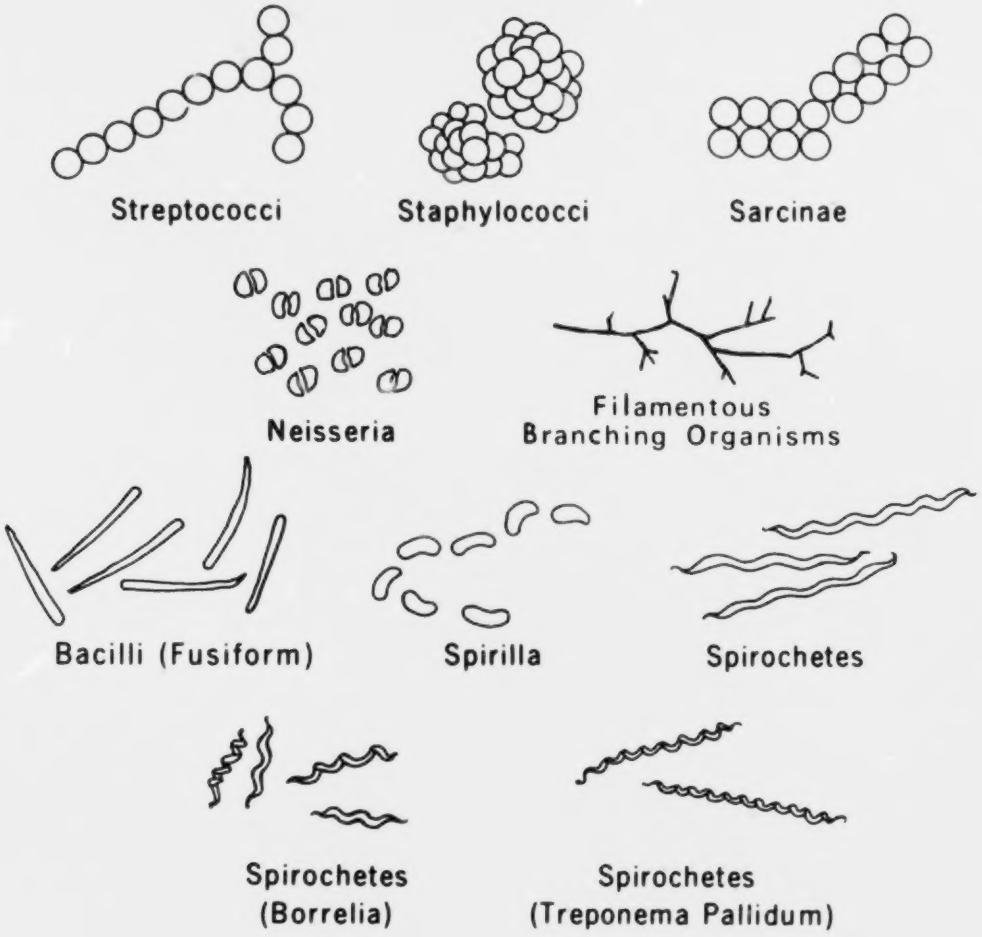


Figure 2-29. Forms of bacteria.

a. Leptothrix (LEP-to-thriks) are Gram-positive, anaerobic, nonmotile, long rod forms. Its long branch extending from the end, resembling a bent twig, distinguishes the Leptothrix from the rod-shaped bacilli.

b. Actinomyces (AK-tin-o-MY-seez) are Gram-positive, anaerobic, nonmotile, multibranching forms, and are classified between fungus and bacteria. They resemble the small branch of a tree, with smaller branches growing from it. *Actinomyces israeli* (one of three pathogenic species of actinomyces) is the one found in the human mouth.

Spirochetes (SPY-ro-keets). These anaerobic organisms are Gram-negative. Their name, which means "coiled hair," is very descriptive of their form, as shown in figure 2-29. They are extremely motile and move in a corkscrew fashion. There are two types:

a. Borrelia (boh-REEL-ee-ah) vincentii are found in acute necrotizing ulcerative gingivitis (ANUG), with the fusiform bacillus. They are comparatively small.

b. Treponema (trep-o-NEE-mah) are larger, extremely motile spirochetes and are rare. The invasion of the Treponema pallidum spirochete results in syphilis.

Exercises (646):

1. Match the description listed in column B with the correct bacterium listed in column A. Use each description only once. used only once.

Column A

____ (1) Cocci.
____ (2) Streptococci.
____ (3) Staphylococci.
____ (4) Neisseria.
____ (5) Veillonella.
____ (6) Bacilli.
____ (7) Spirilla.
____ (8) Filamentous branching organisms.
____ (9) Leptothrix.
____ (10) Actinomyces.
____ (11) Spirochetes.
____ (12) Borellia vincentii.
____ (13) Treponema.

Column B

a. Are large spirochetes, rather rare, and extremely motile.
b. Are comparatively small spirochetes and are found in ANUG.
c. These anaerobic organisms are Gram-negative and their name means coiled hair.
d. They resemble the small branch of a tree, with smaller branches growing from it.

Column A	*Column B*
	e. Are nonmotile, long rod forms and there is usually a long branch extending from the end. Its shape resembles a bent twig.
	f. These are Gram-positive, anaerobic, nonmotile, branching organisms. Found around the teeth in plaque and in calculus.
	g. Are comma-shaped organisms and extremely motile.
	h. They are rod-shaped, about 3 or 4 microns long and 1 micron in diameter.
	i. Strict anerobes that physically resemble the Neisseria. It is not clear whether these organisms should be called pathogens or not.
	j. Are Gram-positive cocci, usually occurring in clusters.
	k. Are Gram-positive, facultative, and grow in clusters.
	l. The most common of all the oral bacteria. They are Gram-positive, facultative, and grow in chains.
	m. They are spherical or oval-shaped. They exist singly or in aggregate.

647. Cite the prevalence of bacteria in the mouth in terms of their method of reproduction, the ways in which saliva is an aid and a deterrent to the growth of bacteria, and the types of bacteria prevalent in conditions of good and poor mouth hygiene.

Prevalence of Oral Bacteria. Only once during your existence is your mouth without oral flora. The oral cavity of a fetus is sterile—but not for long. As the child passes through the birth canal, it picks up bacteria in the mother's vaginal passageway. Shortly after birth, the oral cavity of a baby shows signs of oral flora. Soon the bacteria are flourishing. How? Bacteria do not have seed, give birth, or lay eggs. Instead, each bacterium increases rapidly by dividing into two bacteria. Under proper conditions, some bacteria divide every 15 minutes. The saliva is both an aid and a deterrent to the growth of bacteria. It aids bateria growth by providing warm moisture. Sometimes saliva provides a mechanical means of removing bacteria from the mouth, either by expectorating or by swallowing.

The bacteria in an infant's mouth before tooth eruption are predominantly aerobic, cocci, and short rod forms. With the eruption of teeth, the bacteria are able to creep down into the sulcus. During this stage, the oral flora are predominantly anaerobic, cocci, and short, rod forms. When a person loses his or her teeth (becomes edentulous), the deep crevices of the sulcus are lost and once more the bacteria are predominantly aerobic cocci and rod forms.

Other than the presence or absence of teeth, what else enhances the growth of either aerobic or anaerobic bacteria in one's mouth? Aerobic bacteria are prevalent with good oral hygiene; anaerobic bacteria are prevalent in areas of poor oral hygiene. The greatest number of oral flora are present just before the morning and evening meals.

Exercises (647):

1. How do bacteria increase?
2. How does saliva aid in the growth of bacteria?
3. How does saliva act as a deterrent to the growth of bacteria?
4. Which type of bacteria is prevalent with good oral hygiene?
5. Which type of bacteria is prevalent in poor oral hygiene?

2-10. Preventive Dentistry Counseling

As we stated earlier, preventive dentistry counseling is one of your most important duties because it can motivate the patient to improved oral hygiene. In these counseling sessions you will be amazed at the misconceptions many people have concerning oral health. These misconceptions are normally formed because the patients have not previously received the good, sound professional advice that you provide. Instead, misleading advertising and the unprofessional oral health training they received from their parents have influenced them. It is your job to tactfully and diplomatically correct such misconceptions and educate your patients with an adequate oral health program.

648. Cite ways to show the need for improvement in the patient's cleansing techniques.

Counseling Atmosphere. The atmosphere you create for your counseling session will determine success of the counseling. Position yourself in front of the patient so that you can look directly in his or her eyes and observe the patient's response to your counseling. You may want to repeat or clarify points if the patient's response shows that he or she does not understand or questions what you have said. In most cases, sitting on the operating stool and facing the patient from the front is a good counseling position. This position allows you to view the patient's facial expression. Being at the same eye level as the patient also helps you to establish rapport, since you are not talking "down" to him or her as if you were a monarch.

Talk directly to your patients. Smile occasionally. If you stare at the wall or some other inanimate object during your counseling, the patient will get the impression that you are not sincerely interested in them. Use simple words, and explain any scientific or technical terms with which the patient may not be familiar. Your patient probably does not know that "gingiva" is the technical term for "gums," and they probably think "calculus" is a form of mathematics. You cannot motivate a person to improve their oral health if you talk in terms they do not understand.

Another important way to establish the proper counseling atmosphere is by explaining, or better yet, showing and explaining why good oral health care is needed. Charts and literature that illustrate the progression of caries and periodontal diseases are also fine motivational tools. Do not forget the disclosing agent. It can have the *greatest* impact on the patient. By using this agent before your counseling session, you can actually show the patient the areas his or her cleansing techniques are missing. Again, we repeat a point previously mentioned—your job is not to chastise the patient for past neglect, but to educate and encourage him or her to improve oral hygiene.

Exercises (648):

1. Why should you position yourself so that you can look your patient in the eye when you are counseling him or her?

2. Which item that you use for counseling will probably have the greatest impact on the patient?

3. What should you never do when counseling a patient about his or her oral hygiene program?

649. Specify the most important areas to cover in a dental health talk.

Home Care. Remember that home care is not limited to the home. Several times in this course, the proper method of cleaning teeth has been mentioned, but no details have been given. One of your most important duties is to tell your patients, or your audience during a dental health talk, how to *clean their mouths properly, not just how to brush their teeth*. The difference between dental health and dental disease is not toothbrushing but mouth cleansing. Everybody brushes their teeth, but few thoroughly clean their mouths. Give your patients a step-by-step procedure.

One of the major causes of tooth decay and periodontal disease is bacterial plaque. Bacterial plaque is an almost invisible film of water, containing cells and millions of living bacteria. To prevent dental diseases, you must effectively remove this destructive film at least once during every 24-hour period. By keeping your teeth and gums clean and in good health, you will benefit in the following ways:

a. Have better health.
b. Retain your natural appearance.
c. Enjoy chewing and talking.
d. Prevent bad breath.

Exercises (649):

1. What is the most important thing that you can tell your patients during a dental health talk?

2. What is bacterial plaque?

3. How often must bacterial plaque be effectively removed to prevent dental diseases?

4. List four ways you will benefit by keeping your teeth and gums clean.

650. Cite effective procedures or techniques of good oral hygiene.

Effective Tooth Brushing. The toothbrush can remove the bacterial film from the facial, the lingual, and the occlusal surfaces of the teeth. Brush gently but with enough pressure to feel the bristles on the gum. Do not use so much pressure that you feel discomfort. The method we will describe here is effective and relatively easy for most patients. Sometimes other methods are recommended in special situations, such as malocclusion.

Toothpaste foams and prevents you from seeing if you are placing the brush properly. While a person is learning to brush properly, it is best to omit toothpaste or to use it in a second brushing. Your toothbrush should have soft, multitufted nylon bristles. It should have a straight, rigid plastic handle, and the head should be small and flat. For all facial surfaces and the posterior lingual surfaces, point the bristles at the teeth at a 45° angle. Lay the bristles in the sulcus area and use a gentle vibrating motion. At the end of the vibratory stroke, sweep the bristles toward the incisal edge (fig. 2-30). For the lingual surfaces of the anterior teeth, place the brush as shown in figure 2-31 and use small circular scrubbing strokes. When brushing the occlusal surfaces, place the bristles flat on the surface and use the same scrubbing strokes as for the other surfaces (fig. 2-32). Move the bristles around the mouth in a regular pattern so that you will not skip any areas.

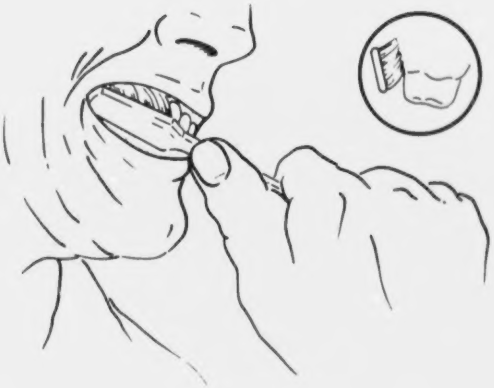


Figure 2-30. Brushing the sulcus area.

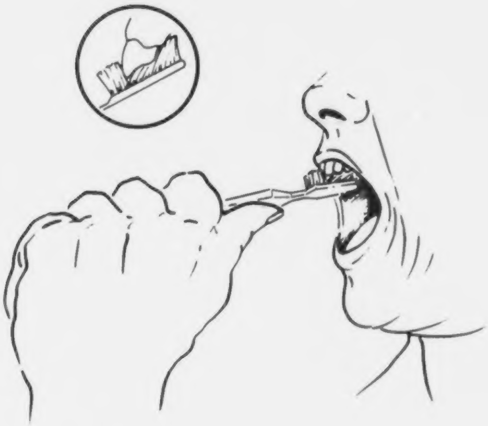


Figure 2-31. Brushing the lingual surface of anterior teeth.

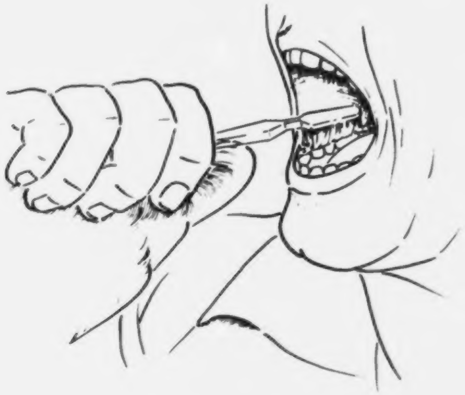


Figure 2-32. Brushing the occlusal surfaces.

Use of Dental Floss. For most people, dental decay and periodontal (gum) disease most often occur between, or on the proximal surfaces, of the teeth. The toothbrush cannot clean these areas effectively or clean behind the last tooth in each arch. Unwaxed dental floss is best for cleaning these areas.

Cut off a piece of floss about 18 inches long and lightly wrap the ends of the floss around your middle fingers, as shown in figure 2-33. To clean between the upper left back teeth, pass the floss over your left thumb and the forefinger of your right hand (fig. 2-34). To see the proper position of the hands, look at figure 2-35. The thumb is placed on the outside of the teeth and helps to hold the cheek back. To clean between the upper right teeth, pass the floss over your right thumb and the forefinger of your left hand. Now the right thumb is outside the teeth and the left forefinger is on the inside. To clean between all lower teeth, hold the floss with the forefingers of both hands (fig. 2-36). You can insert the floss gently between all lower teeth with the floss over your forefingers in this position. Figure 2-37 shows the correct method for "flossing" between the lower back teeth, using the two forefingers to guide the floss:

a. The fingers controlling the floss should not be more than one-half inch apart.

b. Do not force the floss between the teeth. Insert it gently by sawing it back and forth at the point where the teeth touch each other. Let it slide gently into place.

c. With both fingers, move the floss up and down six times on the side of one tooth, and then repeat on the side of the other tooth until the surfaces are "squeaky" clean. Use your fingers to curve or bend the floss around the tooth.

d. Go carefully under the gum line with the floss, since this is a sulcus where plaque collects, but do not go far enough into the gum to cause discomfort, soreness, or bleeding.

e. When the floss becomes frayed or soiled, a turn from one middle finger to the other brings up a fresh section.

f. At first, flossing may be awkward and slow, but continued practice will increase your skill and effectiveness.

Rinse vigorously with water after flossing to remove food particles and plaque that you have scraped loose. Also rinse with water after eating if you are unable to floss or brush. Neither rinsing alone nor water-spraying devices remove the bacterial plaque because of the gluelike material in the plaque.

Exercises (650):

1. What is the disadvantage of using toothpaste while you are learning to brush properly?

2. Briefly describe the design of a good toothbrush.

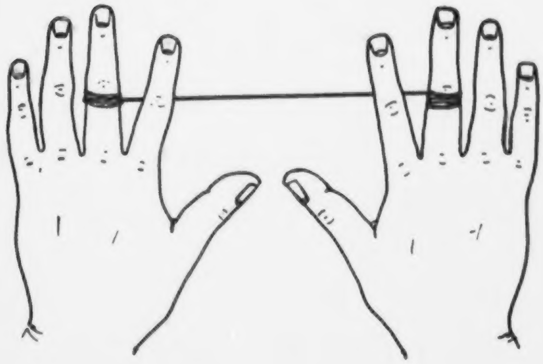


Figure 2-33. Floss position on hands for maxillary teeth.

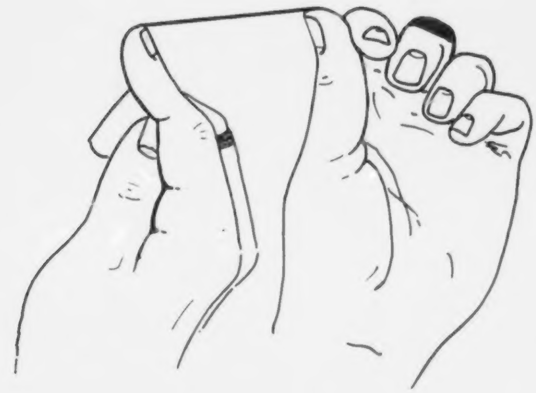


Figure 2-34. Floss position of maxillary posterior teeth.

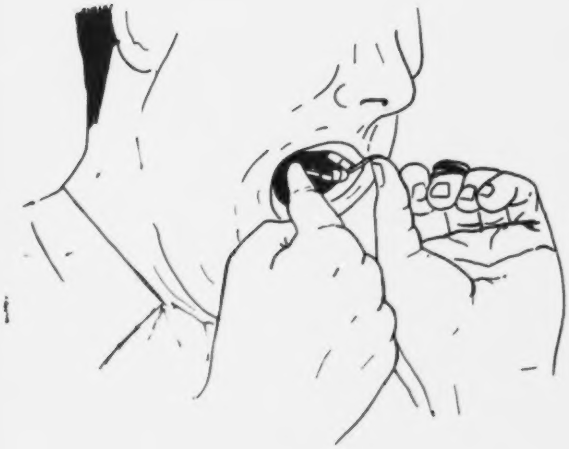


Figure 2-35. Hand position for flossing maxillary posterior teeth.

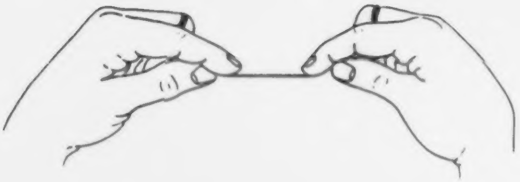


Figure 2-36. Floss position on hands for mandibular teeth.

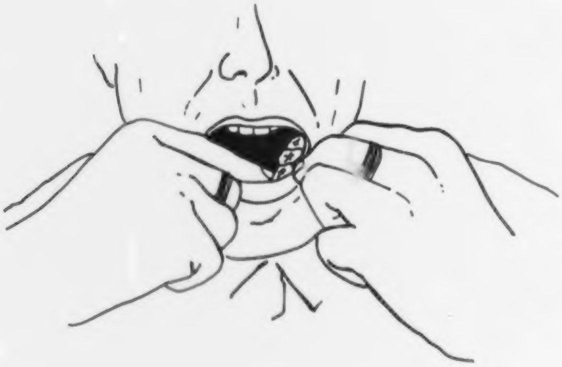


Figure 2-37. Flossing position of mandibular posterior teeth.

3. What type of toothbrushing strokes should be used?

4. What is the most effective item for cleaning the proximal surfaces of the teeth?

5. Which fingers should you use for guiding the floss when you are flossing between the lower back teeth?

6. Briefly state how to safely insert the floss between the teeth.

7. Why should you rinse vigorously with water after flossing?

651. Cite significant facts about cleaning teeth thoroughly, cleaning sensitive teeth, using dentifrice and mouthwash, and cleaning prosthetic appliances.

Evaluation. Are your teeth clean? As a patient, you may be given a disclosing agent to find out if your teeth are really clean. Swish it vigorously around your teeth, swallow and inspect your teeth. Red areas indicate where your teeth are not completely clean. The red is held on the teeth by the bacterial plaque that you failed to remove in cleaning. More red areas usually appear near the gingival margins of the teeth and on the proximal surfaces.

Sensitivity. After treatment of the tooth or gum tissues, the exposed root surfaces may be sensitive to cold and heat. This condition is usually temporary if the teeth are kept meticulously clean. If the teeth are not kept clean, the sensitivity remains and becomes more severe. For the few patients who have severe sensitivity, use specially medicated toothpastes and mouthwashes.

Anticariogenic Agents. Although dentifrices are NOT necessary for good dental health nor for proper cleaning of the teeth, they may have a psychological benefit. Instruct your patients that, if they wish to use a dentifrice, they should do so only after brushing and removing all the plaque.

Maintenance of Prosthetic Appliances. If your patient has a prosthetic appliance, tell him or her to take the removable appliance from the mouth after meals and thoroughly scrub and brush it. Patients should use a good prosthetic appliance brush and their preferred dentifrice or soap and water. Tell the patient to place a towel in the sink, or to fill the sink with water. Then if he or she drops the denture, it will be protected from breaking. The patient should clean and dry the brush after each cleaning. The patient also should follow the dentist's instructions regarding how long to leave the appliance out of the mouth to give the tissues proper rest and how and when to soak the appliance.

Exercises (651):

1. How can you find out whether or not your teeth are really clean?

2. How are patients with severe sensitivity treated?

3. Which type of dentifrice is preferable if a patient wishes to use one, and when should he or she use it?

4. When should a patient remove and clean his or her removable appliance?

Nutrition

DO YOU REALIZE that only one-third of all the people in the world are properly nourished? To be adequately nourished, humans require the proper foods for growth in childhood, for good health during adulthood, and for the building and repair of body tissues throughout life. Nutrition is the process by which humans take in and use food substances.

Before you can adequately understand nutrition, you must understand the human body functions involved in digesting and using these necessary foodstuffs. Although you have already studied the digestive system in a previous volume of this course, we will first review and then further explain the processes of digestion, absorption, and metabolism. You will see how the body must break down a single food, such as whole milk, into various simpler nutrient products before it can use it as food.

To nourish the body properly, the diet must include certain nutrients. (Any substance useful in nutrition can be termed a "nutrient.") In this chapter we will cover the seven nutrient classes that are essential in providing normal nutrition: proteins, carbohydrates, fats, minerals, vitamins, water, and fiber.

One way your patients can limit the amount of acid produced by decay-causing microorganisms in their mouths and maintain healthy periodontal tissues is to have a nutritionally sound diet. You have heard the saying, "You ARE what you eat." Studies show that there is much truth in the saying. In a year's time the body replaces 98 percent of its cells. This constant rebuilding means that adults as well as children need the nutrients in a diet containing the basic four food groups to be discussed later in this chapter. They are comprised of common foods which can supply all of the essential nutrients. Using this *Daily Food Guide* system will enable you to meet the recommended standards required for normal nutrition.

3-1. Digestive System

As you may recall, the primary purpose of the digestive system is to convert food (nutrients) into simpler substances that can enter the blood and nourish the body tissues. Other functions of the digestive system include:

a. Transporting ingested foods and waste products.
b. Secreting acid, enzymes, and bile.
c. Storing waste products.

The digestive system extends from the mouth to the external opening of the rectum, called the anus. Figure 3-1 illustrates the digestive and accessory organs. Here, we will review and then cover in detail the processes of digestion, absorption, and metabolism.

652. Describe the process of digestion.

Digestion. Food changes both physically and chemically during the process of digestion. *Physical* changes are produced by grinding, crushing, and mixing food with digestive juices, and by propelling the food mass through the digestive tract. Reactions between food and enzyme secretions in the digestive system result in *chemical* changes to the food.

Digestive enzymes. Certain enzymes break food particles down into small chemical units, or cause other chemical reactions. In fact, all reactions in the body are caused by enzymes. Each enzyme has its own specific function. The enzyme "amylase" (Latin for starch) acts on starch; the enzyme "lipase" acts on lipids (fats); the enzyme "protease" acts on proteins; and the enzyme "polypeptidase" acts on polypeptides (protein fractions). As you can see, many enzymes derive their names from the substances upon which they act, with the ending "ase" being added to the root word.

Mouth. In the mouth, teeth grind and crush food into small pieces. At the same time, saliva, excreted from the salivary glands and the many minor glands, moistens and softens the food. Saliva contains the enzyme "styalin," which starts to break down starch into sugar.

Food does not remain in the mouth long enough to become liquefied but is softened and made easy to swallow. This food mass is known as a bolus. The bolus passes back to the pharynx and down the esophagus to the stomach.

Stomach. The stomach uses muscular contractions to mix the food with gastric secretions. Food remains in the upper part of the stomach from 30 minutes to 2 hours. It becomes semiliquid and slowly moves downward in small portions.

The stomach secretes a mixture of both digestive enzymes and hydrochloric acid, commonly referred to as gastric juice. As food mixes with gastric juice, it is reduced to a thin souplike mixture known as chyme (kime). The opening from the stomach to the small intestine opens from time to time to allow small amounts of chyme to pass. The emptying time of the stomach depends upon the type and amount of food eaten. After an average meal, a normal stomach should empty itself within 2 to 4 hours.

The chief digestive change in the stomach is the partial breakdown of proteins into proteoses and peptones. Fats undergo very little digestive change in the stomach.

Small intestine. The chyme (liquefied food and gastric juice) contains partially broken down proteins, carbohydrates in various stages of breakdown, and fats as it enters the small intestine. A few of the fats must be

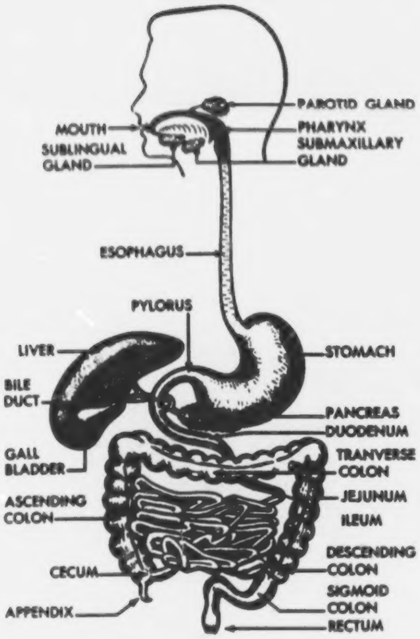


Figure 3–1. The digestive and accessory organs.

emulsified (broken into small globules which will mix with the chyme) before they can be digested and absorbed. From the stomach, chyme first enters the duodenum (DU-o-DE-num), which is part of the small intestine, where it is mixed with intestinal juices, bile from the liver, and digestive enzymes from the pancreas.

Intestinal juices contain enzymes that continue to break down proteoses and peptones into amino acids, and enzymes that convert carbohydrates to simple sugars. Bile is useful chiefly in the emulsification and digestion of fats, whereas enzymes from the pancreas are involved in the digestion of the three nutrients—carbohydrates, proteins, and fats. Digestion proceeds rapidly; and as the chyme passes down the intestine, carbohydrates, proteins, and fats are broken down further into the end products, which are absorbed.

Exercises (652):

1. Food changes both _____ and _____ during the process of digestion.

2. Digestive _________ break food particles down into smaller chemical units, or cause other chemical reactions.

3. Saliva contains the enzyme _____ , which starts to break down starch into sugar.

4. The food mass, known as bolus, passes back to the ______ and down the ______ to the stomach.

5. The stomach uses ______ ______ to mix the food with gastric secretions.

6. As food is mixed with gastric juice in the stomach, it is reduced to a thin souplike mixture called _______ .

7. The emptying time of the stomach depends upon the ______ and ______ of food eaten.

8. The chief digestive change in the stomach is the partial breakdown of proteins into _______ and ______ .

9. From the stomach, chyme first enters the ________ , where it is mixed with intestinal juices, _______ from the liver, and digestive enzymes from the ______ .

10. Bile is useful chiefly in the ________ and ________ of fats.

11. As the chyme passes down the intestine, _________ , ______ , and ______ are broken down further into the end products, which are absorbed.

653. Define absorption; tell the physical and chemical changes that must take place in nutrients before it can occur, the locations in the digestive tract where it takes place, and the functions of intestinal bacteria.

Absorption. Absorption is the process by which the end products of digestion pass through the lining of the small intestine into the blood and lymphatic systems. Usually over 90 percent of a mixed diet is digested and absorbed. Foodstuffs of animal origin are used more completely than vegetable and fruit foodstuffs. Water and simple sugars can be absorbed in their original form. Before complex carbohydrates can be absorbed, they must be broken into simple sugars; proteins must be broken down into amino acids; and fats must be broken down into fatty acids and glycerol.

No absorption takes place in the mouth, and there is very little foodstuff absorpted in the stomach. Alcohol is an exception—it is absorbed directly from the stomach—but nutrient absorption is largely the function of the small intestine.

Food normally remains in the small intestine from 3 to 8 hours. In addition to the digestive juices, the small intestine is also filled with bacteria, which usually are not harmful and perform certain useful functions. One function of intestinal bacteria is to attack plant fiber (bulk) in the chyme. This action brings about further breakdown of this indigestible matter. Also, these bacteria are important in synthesizing (forming) some of the vitamins essential to the body. Absorption continues in the small intestine until most of the nutrients have been absorbed. The water and food particles that have not been absorbed pass into the first segment of the large intestine.

To repeat, most of the available nutrients have already been absorbed from the small intestine. In the large intestine the food mass changes from a liquid to a semisolid state. Considerable amounts of water, including digestive juices, are absorbed from the large intestine during this change. The remaining matter contains only indigestible carbohydrates (fiber) and decomposed food particles. The mass becomes more solid as it moves along the large intestine and is finally excreted as feces.

Exercises (653):

1. Define the absorption process in digestion.

2. Into what substances must complex carbohydrates be broken down before they can be absorbed?

3. In what organ is alcohol absorbed directly into the bloodstream?

4. What organ is primarily responsible for nutrient absorption?

5. What are the functions of intestinal bacteria?

6. What change occurs in the food mass when it is in the large intestine?

654. Define metabolism and explain it in terms of classes of food used by the body as fuel, their caloric values, factors that determine the body's need for calories, and the number of calories required for a regular diet.

Metabolism. Generally, absorbed nutrients are carried in the blood to the muscles, liver, and other organs for immediate use or for storage. The use of food nutrients by body cells is known as cell metabolism. Metabolism is the chemical process of either changing (building) the absorbed foods into complex tissue elements or transforming (breaking down) complex body elements into simple ones, along with the production of heat and energy.

The building of body tissues from foods is very apparent during childhood, when growth is most rapid. Actually, it never stops. In adulthood old cells must be repaired or replaced by new cells. The breakdown of tissue into simpler elements always yields energy. As you can see, cell metabolism does mean change (building and breakdown, both of which occur simultaneously throughout life).

Fuel measurement. The calorie is a standard unit for measuring heat. Since heat results from the body's energy expenditure, the calorie is a measure of energy metabolism. Each food has a specific caloric value—a given amount of food will yield a certain amount of heat when it is metabolized. (This amount of heat is expressed as a number of calories.) Of the seven nutrient classes, proteins, fats, and carbohydrates are the only ones that the body can use as fuel sources. A food's yield in calories depends upon its composition in terms of these three nutrients. The following values have been established:

- 1 gram of protein yields 4 calories.
- 1 gram of carbohydrate yields 4 calories.
- 1 gram of fat yields 9 calories.

You can use these figures to estimate the caloric values of foods in the diet. For example, if 240 ml (8 oz) of whole milk contain 12 grams of carbohydrate, 8 grams of protein, and 10 grams of fat, the caloric value can be determined as follows:

12 carbohydrate × 4 yields	48 calories
8 protein × 4 yields	32 calories
10 fat × 9 yields	90 calories
	170 calories per 240 ml (8 oz) whole milk

Caloric requirements. Many factors control the body's need for calories. Among the most obvious are:

a. Age and growth. The need for calories and various nutrients is increased greatly during growth periods. Energy needs are the greatest during the first 2 years of life. Another increase occurs during adolescence, but during adulthood the body's energy needs decline steadily.

b. Climate. Since energy metabolism produces heat, which regulates body temperature, caloric requirements are increased in cold climates or environments. In hot climates, the caloric requirements are decreased.

c. Physical activity. Muscular work (physical activity) is the most important factor influencing caloric needs. A warehouse worker, whose job requires constant physical exertion, needs about 5,000 calories a day; on the other hand, a clerk typist with the same body build and age, in a similar climate, requires only about 2,000 calories a day. Generally, the *food intake* should meet the *energy output*. For persons who want to lose weight, food energy intake must be less than energy output. For persons who want to gain weight, food energy intake must be greater than energy output.

Generally, a person's regular diet should supply between 2,200 and 3,200 calories per day, depending upon specific menu items chosen and the quantities consumed. Additional milk, bread, butter, and second portions provide the higher caloric intakes needed for the young and physically active. In addition to an individual's caloric requirement, specific nutrients must be provided in their daily diet.

Exercises (654):

1. Define metabolism.

2. What are the three nutrient classes the body can use as fuel?

3. How many calories does 1 gram of carbohydrate yield?

4. When are the energy needs of the body the greatest?

5. Do caloric requirements increase or decrease in cold climates?

6. With the exception of persons who need to lose weight, the food intake should correlate with what?

7. What is the daily caloric requirement?

3-2. Protein

Every living cell, animal or vegetable, contains protein. All protein is composed of carbon, hydrogen, oxygen, and nitrogen. Certain mineral elements, such as sulfur, iron, phosphorus, or iodine, may or may not be present. Nitrogen, the most important of these elements, distinguishes protein from carbohydrate and fat. Nitrogen is important because it is essential for the repair and maintenance of every living body cell.

655. What is the importance of protein to nutrition?

Essential Amino Acids. Protein can be broken down into smaller parts, which are called amino acids. There are 22 known amino acids, 9 of which are essential for humans. These essential amino acids cannot be synthesized (made) by the body and must be supplied in the diet. Each of these particular amino acids plays an important specific function in the body.

Functions. Protein is the chief component of muscles and glandular tissues. The cells of these body tissues are in a state of constant and rapid breakdown, and an equally constant and rapid buildup of new cells is needed to balance the breakdown. Therefore, amino acids must be present to supply the materials for the replacement of cell proteins throughout life. During periods of growth, the body needs additional amino acids. During growth, there is a need not only for the maintenance of the existing cells, but also for the formation of new cells. The production of new cells demands a high intake of foods containing the essential amino acids. In addition to childhood and teenage growth periods, new cell production occurs during pregnancy, when the mother must maintain her own body tissues and also provide for the demands of the developing baby. After birth, the production of human milk, called lactation, increases her protein requirements. Illness and increased activity also increase protein needs.

Proteins regulate the body processes. Hemoglobin, a chief part of the red blood cells, is a protein that contains iron. Hemoglobin nourishes the body by carrying oxygen to the tissues. Blood plasma proteins help to regulate the body's water balance. Digestive enzymes are also proteins. The formation of certain hormones depends upon the availability of some amino acids, and the body's resistance to disease is maintained in part by protein antibodies.

If the body's fuel energy need is not met by a sufficient amount of carbohydrates and fats, the body can use proteins as a source of fuel. As you remember, 1 gram of protein supplies 4 calories. However, protein is not an economical source of energy. First of all, foods containing proteins (such as meats) are usually more expensive than foods containing carbohydrates (such as bread and potatoes). Second, protein is harder to break down in the body, which is a cost in body work. For these reasons, we normally do not depend on proteins as an energy source.

Exercises (655):

1. Protein can be broken down into smaller parts, which are called ______ ______ .

2. There are ______ amino acids essential for humans.

3. Amino acids must be present to supply the materials for the replacement of ______ ______ throughout life.

4. ______ , a chief part of red blood cells, is a protein containing iron.

5. ______ ______ proteins help to regulate the body's water balance.

6. If the body's energy needs are not met by a sufficient amount of ______ and ______ , the body can use proteins as a source of fuel.

656. Analyze the digestion and absorption of protein in terms of body location, body secretions responsible, and the body's priorities in the use of protein.

Digestion and Absorption. The body cannot use protein until it is broken down into amino acids. The first digestive action on proteins occurs in the stomach. Proteins are split by the enzyme, pepsin, into polypeptides (smaller proteins).

The digestion of proteins continues in the small intestine. The final breakdown into amino acids is caused by a group of enzymes secreted by the intestinal mucosa. Amino acids are then absorbed through the intestinal walls and carried in the blood directly to the tissues or liver.

Metabolism. As amino acids circulate in the bloodstream, they are used for one of the following:

- Tissue synthesis.
- Manufacture of regulatory products.
- Deamination.

First, amino acids needed for synthesis and repair are selected by the body tissues. Second, amino acids are selected for the manufacture of other products, such as hormones, enzymes, and antibodies. This selection probably occurs in the liver. Amino acids not used in either of the first two functions are deaminized by the liver. In this process, the group containing nitrogen is separated from the amino acid. If it is not needed, it will be eliminated by the kidneys as urea. The remaining part of the amino acid, which contains carbon, hydrogen, and oxygen, may be converted to carbohydrate or body fat.

Exercises (656):

1. Where does the first digestive action on proteins occur?

2. What causes the final breakdown of protein into amino acids?

3. Which amino acids are selected first for use by the body? Which are selected second?

4. What happens to the amino acids not used in the first two functions?

657. Identify facts concerning dietary allowances, deficiency symptoms, and food sources for proteins.

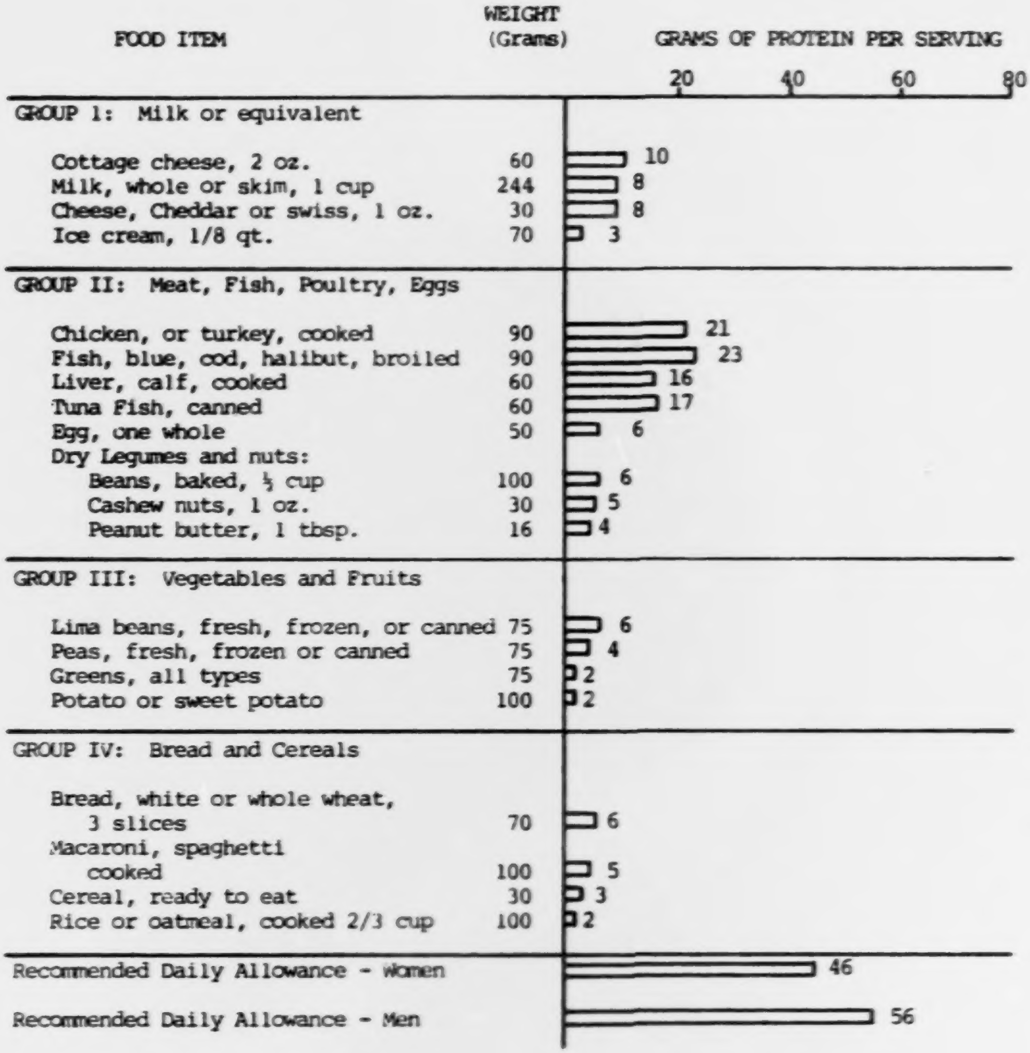
Dietary Allowances. From studies conducted during and after World War II, much has been learned about our protein needs. These studies have shown that people can adapt to various levels of protein intake, though the trend today is to recommend a liberal intake of protein for persons of all ages. A liberal allowance can meet other needs besides growth and maintenance. For instance, extra protein can provide a level of resistance to infection.

The *Recommended Dietary Allowances* suggests 65 grams of protein daily for the average man and 55 grams of protein for the average woman. Air Force dietary standards for protein are 100 grams for the military man and 60 grams for the military woman. Protein requirements may be further increased during periods of hard physical labor, prolonged illness, or recovery from surgery. Protein intake for children and the pregnant or lactating woman must be adequate for the reasons already mentioned. However, any protein allowance must take into account the quality of the protein eaten.

Remember that a *complete* protein contains all of the essential amino acids needed for growth and maintenance. These complete proteins are usually found in animal sources. It is recommended that at least one-third of an adult's daily allowance of protein be obtained from animal sources and that for the growing child one-half to two-thirds be complete protein.

Deficiency Symptoms. Protein deficiency (a lack of protein in sufficient quantities or quality) is not rare. Protein depletion in the body can occur for several reasons, the most frequent of which is an inadequate intake of protein. Certain illnesses or injuries can add to the body's depletion. Improper digestion and absorption, excessive metabolism of protein (in fevers), excessive loss of protein (burns or hemorrhage), and failure to synthesize proteins can all cause protein deficiency. Weakness and loss of weight are symptoms of inadequate dietary proteins, though the edema that accompanies a protein deficiency makes loss of weight hard to notice. Children lacking protein become emaciated, and their growth is retarded.

Food Sources. Figure 3-2 lists the amounts of protein found in average servings of various foods. As a rule, proteins from animal sources (lean meats, eggs, fish, poultry, milk, and other daily products) furnish greater amounts of the essential amino acids than do proteins from plant sources. However, some plant sources (soybeans, peanuts, and other legumes) may lack only one essential amino acid. If these grains and cereals are used with a



FOOD ITEM	WEIGHT (Grams)	GRAMS OF PROTEIN PER SERVING
GROUP 1: Milk or equivalent		
Cottage cheese, 2 oz.	60	10
Milk, whole or skim, 1 cup	244	8
Cheese, Cheddar or swiss, 1 oz.	30	8
Ice cream, 1/8 qt.	70	3
GROUP II: Meat, Fish, Poultry, Eggs		
Chicken, or turkey, cooked	90	21
Fish, blue, cod, halibut, broiled	90	23
Liver, calf, cooked	60	16
Tuna Fish, canned	60	17
Egg, one whole	50	6
Dry Legumes and nuts:		
Beans, baked, ½ cup	100	6
Cashew nuts, 1 oz.	30	5
Peanut butter, 1 tbsp.	16	4
GROUP III: Vegetables and Fruits		
Lima beans, fresh, frozen, or canned	75	6
Peas, fresh, frozen or canned	75	4
Greens, all types	75	2
Potato or sweet potato	100	2
GROUP IV: Bread and Cereals		
Bread, white or whole wheat, 3 slices	70	6
Macaroni, spaghetti cooked	100	5
Cereal, ready to eat	30	3
Rice or oatmeal, cooked 2/3 cup	100	2
Recommended Daily Allowance - Women		46
Recommended Daily Allowance - Men		56

Figure 3-2. Amounts of protein in various foods.

source of complete protein, such as milk, or if they are enriched, as are some breads with lysine, they become very good sources of protein. Menus should include both animal and plant sources of protein. This precaution will help to ensure that all essential amino acids are available in adequate amounts.

Exercises (657):

Specify whether the following statements are true (T) or false (F) by circling the appropriate T or F. Explain any false answers.

T F 1. Air Force dietary standards for protein are 100 grams for the military man and 60 grams for the woman.

T F 2. A complete protein contains all of the essential amino acids required for growth and maintenance.

T F 3. Complete proteins are usually found in plant sources.

T F 4. Weakness and loss of weight are symptoms of inadequate protein in the diet.

T F 5. If soybeans are used with milk, they become a very good source of protein.

T F 6. Dairy products provide smaller amounts of the essential amino acids than do proteins from plant sources.

3-3. Carbohydrates

Carbohydrates are by far the most abundant food and are the body's most economical source of energy. They provide 45 to 50 percent of the calories in the American diet and a higher percentage in the diets of many other people in the world.

658. Name the three main kinds of carbohydrates and state some of their characteristics.

Classification. There are three main kinds of carbohydrates: simple and double sugars, starches, and cellulose. Since we cannot digest cellulose, we ordinarily think of only sugars and starches when we say carbohydrates. Cellulose, however, provides the very important fiber (bulk) in the diet. We will discuss cellulose later.

Simple and double sugars. The simple sugars are glucose (dextrose), which is the sugar in the blood, muscles, and liver; fructose (fruit sugar), which is found in fruits and honey; and galactose, which is formed in the body by the digestion of milk. Double sugars include the sucrose found in cane sugar and beet sugar, the maltose in malted drinks, and lactose in milk.

Starches. Starches are more complex sugars, and they are our cheapest source of energy. Grains (wheat, corn, rice) and vegetables (potatoes, dried peas, beans) are the chief sources of starch.

Functions. The chief function of carbohydrates is to furnish a direct and immediate source of energy to the tissues of the body. It can be stored in the liver as glycogen, sometimes called animal sugar, or it can be converted into fatty tissue and stored as a reserve form of energy.

If a sufficient amount of carbohydrate is present, the available protein will not be used as a source of energy. This, of course, is an important function of carbohydrate—to leave the protein available for its primary functions, the growth and maintenance of body tissues.

Also, carbohydrate is needed to prevent the excessive oxidation of fat. In the absence of carbohydrate, fats are oxidized too fast, accumulating incompletely oxidized products in the blood. This condition produces acidosis or ketosis.

One sugar, lactose, has a special function because it is less soluble than the other sugars. For this reason, it remains in the intestine long enough to promote bacterial growth, which is important in the formation of vitamins, such as K and niacin.

Exercises (658):

1. Name the three main kinds of carbohydrates.

2. Which kind of carbohydrate provides the fiber required in the diet?

3. Fructose is categorized under which main kind of carbohydrate?

4. What is the chief function of carbohydrate?

5. What will happen to fat in the absence of carbohydrate?

6. Because lactose is less soluble than other sugars, it has a special function. What is it?

659. Describe the absorption and digestion of carbohydrates.

Digestion and Absorption. The simple sugars can pass through the absorbing walls of the intestine, but the double sugars, such as sucrose and lactose, must be split into simple sugars before they can be absorbed through the intestinal walls. Complex sugars (starches) also must be split into simple sugars for absorption.

Cooking starchy foods aids in the digestive process. Heating ruptures the cells' walls, so that the digestive enzymes can act upon the material more quickly. For this reason, cooked vegetables are included in diets designed for easier digestion.

Exercises (659):

1. The simple sugars can be _______ through the walls of the ______ .

2. ______ or ______ starchy foods ruptures the cells' walls so that ______ ______ can act upon the material more quickly.

660. Explain important steps in the metabolism of carbohydrates.

Metabolism. After digestion and absorption, simple sugars are changed into glycogen by the action of insulin, a hormone produced and secreted by the pancreas. Glycogen is then stored in the liver. Other hormones in the liver convert glycogen to glucose as needed, and the liver releases it to maintain a specific level of glucose in the blood. The normal level of blood glucose is between 80 to 120 mg per 100 cc. Diabetes and other similar diseases are produced by the body's inability to maintain normal blood glucose levels.

The blood carries glucose to the tissue cells, where it furnishes the energy the cells need to carry on their work. The mineral phosphorus, vitamins (such as thiamine, riboflavin, niacin), and oxygen play important parts in the oxidation or burning of glucose in the body tissues to produce energy. This reaction produces heat, which aids in regulating body temperature. Carbon dioxide and water are the end products of glucose oxidation. The carbon dioxide is released through the lungs and the water through the kidneys.

Although some glycogen remains in the liver as a reserve sugar, excess glucose is converted to fatty tissues. When a person continues to eat an excess of carbohydrate, fatty tissue keeps building and the person becomes overweight.

Exercises (660):

1. How are simple sugars changed into glycogen?

2. What happens to glycogen when it is stored in the liver?

3. What are the end products of glucose oxidation?

4. What happens to excess glucose?

661. List five reasons for including carbohydrates in the diet; describe four injurious results of excessive carbohydrate consumption; and identify selected foods as sugar or starch.

Dietary Allowances. Eating foods containing carbohydrate is desirable for a number of reasons. Carbohydrates:

a. Are easily digested and almost completely absorbed.
b. Are an economical energy source.
c. Can be stored as glycogen in the liver.
d. Store protein for its more important functions.
e. Enhance the palatability of the diet.

There are several problems, however, associated with high carbohydrate diets. Highly refined cereal foods have largely replaced whole grain cereal products. In the refining process, most of the vitamins, minerals, and proteins are lost, and only carbohydrates remain. Therefore, a diet containing only refined cereals provides adequate energy levels without providing the other required nutrients. Most, but not all, refined cereal products are now being enriched with vitamins and minerals, some even with certain amino acids. This enrichment is very important, especially if diets consist largely of the less expensive cereal products.

An excess of carbohydrate in the form of concentrated sweets can irritate the stomach and intestines. This excess can also cause fermentation and gas formation in abnormal conditions. Sweets can dull the appetite for other important foods, and excessive use of sugar can cause tooth decay. Thus, when you plan to diet or give diet instructions, be careful not to substitute carbohydrates for other needed nutrients.

Food Sources. Granulated table and confectioner's sugar, honey, corn and maple syrups, molasses, jellies, jams, preserves, marmalades, candies, sweet chocolate, and cocoa are sources of sugar. Examples of starchy foods include cooked cereals, ready-to-serve cereals, flours, macaroni, spaghetti, noodles, breads, pastry, puddings, cakes, dried peas and beans, potatoes, and other root vegetables.

Exercises (661):

1. What are five reasons for including carbohydrates in the diet?

2. What problems arise when a diet contains an excess of carbohydrates in the form of concentrated sweets?

3. Is corn syrup considered a source of sugar or a starchy food?

4. Pastry is an example of _______ foods.

3-4. Fats

Like carbohydrates, fats are made up of carbon, hydrogen, and oxygen. The term "lipid" is used to identify any fat, oil, or fatlike substance. Lipids that are liquid at room temperature are usually called oils, while those that are solid are called fats. Fats are made up of fatty acids in a complex structure, are insoluble in water, and are greasy to touch.

662. Classify fats according to contents.

Classification. Fats are classified according to the fatty acids they contain. Different types of fatty acids have different flavors, textures, and melting points, but all fatty acids are either "saturated" or "unsaturated." Generally, fats from animal sources, such as egg yolks and lard, contain saturated fatty acids, and fats from vegetable sources, such as corn oil and soybean oil, contain unsaturated fatty acids.

Although you do not need to know the chemical formula for each fatty acid, you should know basically how saturated and unsaturated fatty acids differ and especially which food fats fall into each group.

As we stated earlier, fats (fatty acids) all contain carbon, hydrogen, and oxygen. Saturated fatty acids contain all the hydrogen atoms possible. Fats formed mostly by saturated fatty acids are usually, but not always, solid at room temperature. For instance, butter and lard contain high percentages of saturated fatty acids. Unsaturated fatty acids do not contain all the possible hydrogen atoms, and are referred to as "monounsaturated" and "polyunsaturated." Monounsaturated fatty acids have only one missing hydrogen atom; polyunsaturates have more than one missing hydrogen atom. A monosaturated fatty acid is oleic acid, found in various animal and plant sources. Linoleic, a polyunsaturated fatty acid, is found in corn, safflower, and soybean oils.

Exercises (662):

1. Fats are classified according to the types of ______ ______ ______ which they contain.

2. Generally, fats from animal sources contain ______ fatty acids; and fats from vegetable sources contain ______ fatty acids.

3. All fats contain _____ , _______ , and oxygen.

4. Butter and lard are fats containing high percentages of ______ fatty acids.

5. In ________ fatty acids, only one hydrogen atom is missing.

663. Specify the importance of fats in the diet.

Functions. Every gram of fat used as fuel in the body yields nine calories, but a gram of protein and a gram of carbohydrate yields only four calories each. For this reason, fats are the most concentrated sources of energy and supply a large percentage of the calories. Low fat diets must contain a large amount of food to provide sufficient energy from carbohydrate and protein.

Brain and nerve tissue structures and functions depend upon certain fats that help other fatty substances pass in and out of cells. Cholesterol, a fatlike substance in the body, also appears to aid in transporting some of the fatty acids.

Fats also serve as padding around vital organs; help to conserve body heat; store proteins as a source of energy; and store certain vitamins, especially thiamine and niacin. Fats are carriers of fat-soluble vitamins A, D, E, and K. They act as lubricants in the gastrointestinal tract and promote the elimination of waste products. They also delay the emptying of the stomach by slowing its secretion of gastric acids. The odors and flavors of fats add considerably to the palatability of the diet.

There are three essential unsaturated fatty acids—*linoleic*, *linolenic*, and *arachidonic*—which cannot be formed by the body and are essential for proper nutrition. A prolonged dietary lack of these essential fatty acids can result in eczema and other skin disturbances. Fortunately, the essential fatty acids are found in abundance, and dietary deficiencies are uncommon. Arachidonic acid is found in such animal fats as butter and whole milk. Linoleic and linolenic acids are found more abundantly in plant sources, such as corn, soybean, and cottonseed oils. Significant amounts of linoleic acid are also found in fish, poultry, and pork.

Exercises (663):

1. The fatlike substance, cholesterol, appears to have what function?

2. Which vitamins are stored by fats?

3. Fats are carriers of which fat-soluble vitamins?

4. What can result from a lack of linoleic, linolenic, and arachidonic acids?

664. Analyze significant points about the digestion and absorption of fats, and the harm in ingesting mineral oil at meal time.

Digestion and Absorption. Almost all digestion of fats occurs in the intestinal tract. The stomach plays an important role by storing the fats so that they do not empty into the intestine too quickly.

After eating fats, you have a feeling of fullness and a delay in the return of hunger because fats remain in the stomach for longer periods. Fats retard digestion, so glucose absorption continues gradually, and excess stomach motility is avoided. This is an important factor to consider in certain diseases, such as peptic ulcer.

Before fats can be absorbed in the small intestine, they must be split into smaller droplets. As you have already learned, bile, a liver secretion, and the enzymes of the pancreas are the agents that split fats up (emulsify) and allow them to dissolve into the body fluids.

The body digests approximately 95 percent of the common fats, although fried foods are often considered hard to digest. Actually, there is a delay in the digestion of fried foods because the enzymes do not attack the food particles coated with fat as quickly. If frying fat is overheated, it breaks down to form waste products, which can cause indigestion. These wastes may irritate the gastrointestinal (digestive) tract, even to the point of causing diarrhea. Foods that are fried properly will not cause this irritation.

Mineral oil cannot be digested or absorbed in the body; therefore, it is not a true dietary fat. If taken with food, it can interfere with the absorption of fat-soluble vitamins. For this reason, it should never be used as a salad oil or taken for medicinal purposes at meal times.

Exercises (664):

1. Where are most of the fats digested?

2. What must happen to fats before they can be absorbed in the small intestine?

3. What agents split fats and allow them to dissolve into the body fluids?

4. Why should mineral oil never be used as a salad oil?

665. Analyze the metabolism of fats under the normal and abnormal conditions in which fats must be used as the body's chief source of energy, and list three causes of ketosis.

Metabolism. A few hours after absorption, fats leave the blood and go into the body's tissues. Some fats are burned for energy, and others are stored as body fat, to be used later as a source of energy.

Problems can arise if the body must use fat as its chief source of energy. Acetone or ketone bodies are the immediate products of fat metabolism. In certain situations, ketone bodies are produced more rapidly than the tissues are able to convert them to carbon dioxide and water. When this occurs, they accumulate in the bloodstream and are excrete in the urine. This condition, known as ketosis, can result from the following three conditions: (1) when the dietary carbohydrate is very low and the level of fat is high; (2) during extreme caloric restriction, or starvation, when body fat reserves are used for the energy requirements; and (3) when there is a disturbance in carbohydrate metabolism, as in uncontrolled diabetes mellitus. Ketosis and acidosis (accumulation of acetones) are undesirable conditions and require medical treatment.

Exercises (665):

1. What happens to fats after they have entered the body's tissues?

2. What happens when ketone bodies are produced more rapidly than the tissues are able to convert them to carbon dioxide and water?

3. Name the three conditions under which ketosis may result.

666. Point out the result of a caloric intake in excess of an individual's energy needs, and specify the percentage of fats that should be included in the total diet.

Dietary Allowances. There is a very limited nutritional requirement for fat, aside from meeting the need for the essential fatty acids. The average American diet receives 40 to 60 percent of its calories from fat. Although fats perform the important functions we have discussed, diets can contain too much fat.

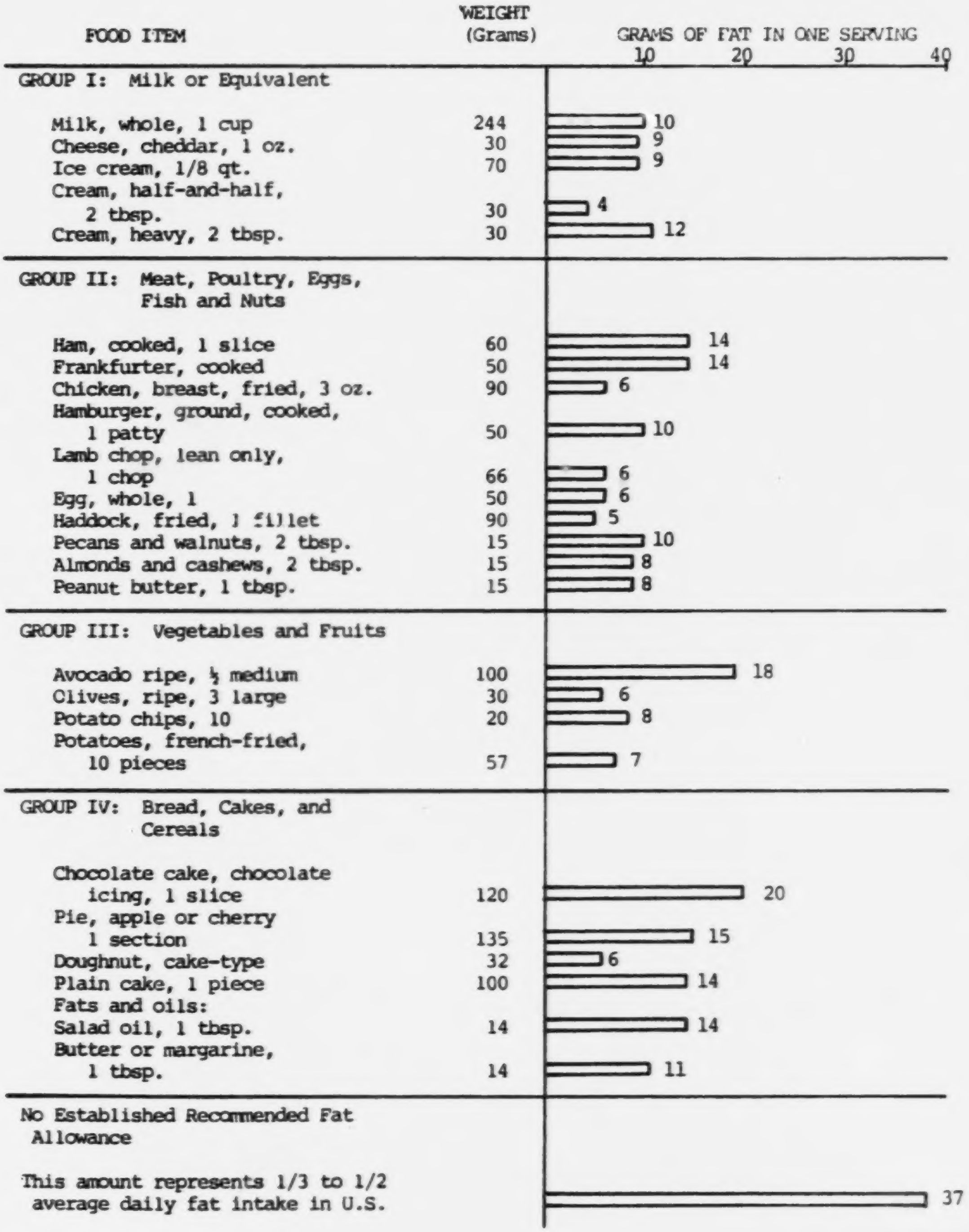
As you have seen, 1 gram of fat contains 2¼ times as many calories as 1 gram of protein or carbohydrate. If an individual's caloric intake exceeds his or her energy needs, deposits of fat occur. Not only does this cause obesity, but the excess fatty tissue around the heart, kidneys, and liver impairs their functions. Normal adults can adjust to an increased fat intake quickly; but some individuals, and especially infants, have a low tolerance for fat. For these reasons, a diet containing fat between 20 to 40 percent of the total calories is recommended.

Food Sources. Vegetable and seed fats are good sources of the essential fatty acids. Examples are corn, soybean, peanut, and cottonseed oils. Brains, liver, egg yolk, and butter are also good sources. High percentages of fat can also be obtained in whole milk, meats, whole milk cheeses, cream, olives, nuts, and chocolate (see fig. 3-3).

Exercises (666):

1. What happens when an individual's caloric intake exceeds his or her energy needs, causing deposits of fat to occur?

2. Specify the recommended percentage of fats in the diet.



FOOD ITEM	WEIGHT (Grams)	GRAMS OF FAT IN ONE SERVING
GROUP I: Milk or Equivalent		
Milk, whole, 1 cup	244	10
Cheese, cheddar, 1 oz.	30	9
Ice cream, 1/8 qt.	70	9
Cream, half-and-half, 2 tbsp.	30	4
Cream, heavy, 2 tbsp.	30	12
GROUP II: Meat, Poultry, Eggs, Fish and Nuts		
Ham, cooked, 1 slice	60	14
Frankfurter, cooked	50	14
Chicken, breast, fried, 3 oz.	90	6
Hamburger, ground, cooked, 1 patty	50	10
Lamb chop, lean only, 1 chop	66	6
Egg, whole, 1	50	6
Haddock, fried, 1 fillet	90	5
Pecans and walnuts, 2 tbsp.	15	10
Almonds and cashews, 2 tbsp.	15	8
Peanut butter, 1 tbsp.	15	8
GROUP III: Vegetables and Fruits		
Avocado ripe, ½ medium	100	18
Olives, ripe, 3 large	30	6
Potato chips, 10	20	8
Potatoes, french-fried, 10 pieces	57	7
GROUP IV: Bread, Cakes, and Cereals		
Chocolate cake, chocolate icing, 1 slice	120	20
Pie, apple or cherry 1 section	135	15
Doughnut, cake-type	32	6
Plain cake, 1 piece	100	14
Fats and oils:		
Salad oil, 1 tbsp.	14	14
Butter or margarine, 1 tbsp.	14	11
No Established Recommended Fat Allowance This amount represents 1/3 to 1/2 average daily fat intake in U.S.		37

Figure 3–3. Amounts of fat in various foods.

3-5. Minerals

All plant life, animals, and bacteria need certain minerals to live. Though mineral elements constitute only 4 percent of body tissue, they are essential for proper body structure and many vital processes. Some minerals form hard bones and teeth; others help to make up body fluids and some tissues. Some minerals function only when they are in proper balance with other minerals, and some act as catalysts in certain enzyme systems.

The principal minerals required by the human body are calcium, phosphorus, iron, iodine, magnesium, sodium, and potassium. Several other minerals are used in trace amounts and are grouped together as micronutrients: sulfur, chlorine, copper, manganese, cobalt, zinc, fluorine, molybdenum, selenium, and chromium. A few other trace elements are present in the body, but their function is uncertain. However, a diet that supplies the principal minerals in the proper quantities usually supplies the trace minerals adequately. In the following paragraphs we will discuss each principal mineral, and briefly discuss the micronutrients.

667. Identify facts concerning the importance of calcium in the diet.

Calcium. Calcium is the most abundant mineral in the body, and 99 percent of this mineral is found in the bones and teeth.

Functions. Calcium functions mainly to give strength and hardness to the bones and teeth. For calcium to perform this function, phosphorus must also be present. The remaining portion (1 percent) of calcium is responsible for a variety of functions. Calcium is needed in the blood for proper clotting, for muscle contraction, for the efficient use of iron, and for the functioning of some of the enzymes.

Dietary allowances. The *Recommended Dietary Allowances* gives the calcium requirement as 0.8 grams for the average person. his requirement is higher, weight-for-weight, during growth periods, since calcium plays such an important role in bone development. The allowances for teenagers and for pregnant and lactating women are much higher than for the average person.

Although calcium is the most abundant mineral in the body, it is usually low in the American diet. Milk is the outstanding dietary source of calcium; without it, a satisfactory calcium intake is extremely difficult. Also, the ability to absorb and use calcium differs greatly between individuals. Other materials present in the intestinal tract can combine with calcium to form indigestible salts or to interfere with the absorption of calcium. Chocolate is a strong deterrent to the absorption of calcium and should not be used with milk.

Exercises (667):

1. Calcium's main function is to give _______ and _______ to the body's bones and teeth. To perform this function, ______ must be present with calcium.

2. Calcium is needed in the blood for ______ ______, muscle ________, efficient use of _______, and the functioning of some enzymes.

3. The *Recommended Dietary Allowances* gives the calcium requirement as _______ grams for the average person.

668. Cite the results of calcium deficiency in a child and in an adult, and list three vegetables that are good sources of calcium.

Deficiency symptoms. Calcium deficiency results in poor tooth structure, stunted growth, and fragile bones. Usually, in children, acute calcium deficiency also involves a lack of phosphorus and vitamin D. The result of such deficiencies may be rickets with its characteristic signs—bowed legs, enlarged wrists and ankles, and a hollow chestbone.

In adults the need for calcium is reduced, but deficiencies can occur. Adults *do* require calcium. Without it, they are subject to muscle twitches, cramps in their legs and feet, and resultant insomnia, irritability, and nervousness. Depletion of bone calcium can produce fragile bones that fracture easily. This condition is seen especially in elderly people.

Food sources. As figure 3-4 shows, milk and milk products are the chief food sources of calcium. For the adult, 2 to 3 cups of milk daily, and for the child, 3 to 4 cups daily, will ensure an adequate calcium intake. Kale, mustard, and turnip greens are also good sources of digestible calcium. Eggs, legumes, and cereal products contribute lesser amounts.

Exercises (668):

1. What are the physical results of a calcium deficiency in a child?

2. What are the symptoms of calcium deficiency in an adult?

3. Name three vegetables that are good sources of calcium.

669. Classify the functions of phosphorus in body cells and in metabolism.

Phosphorus. Approximately 70 to 75 percent of body phosphorus is combined with calcium in bone structures, and 25 to 30 percent is in the soft tissues and body fluid.

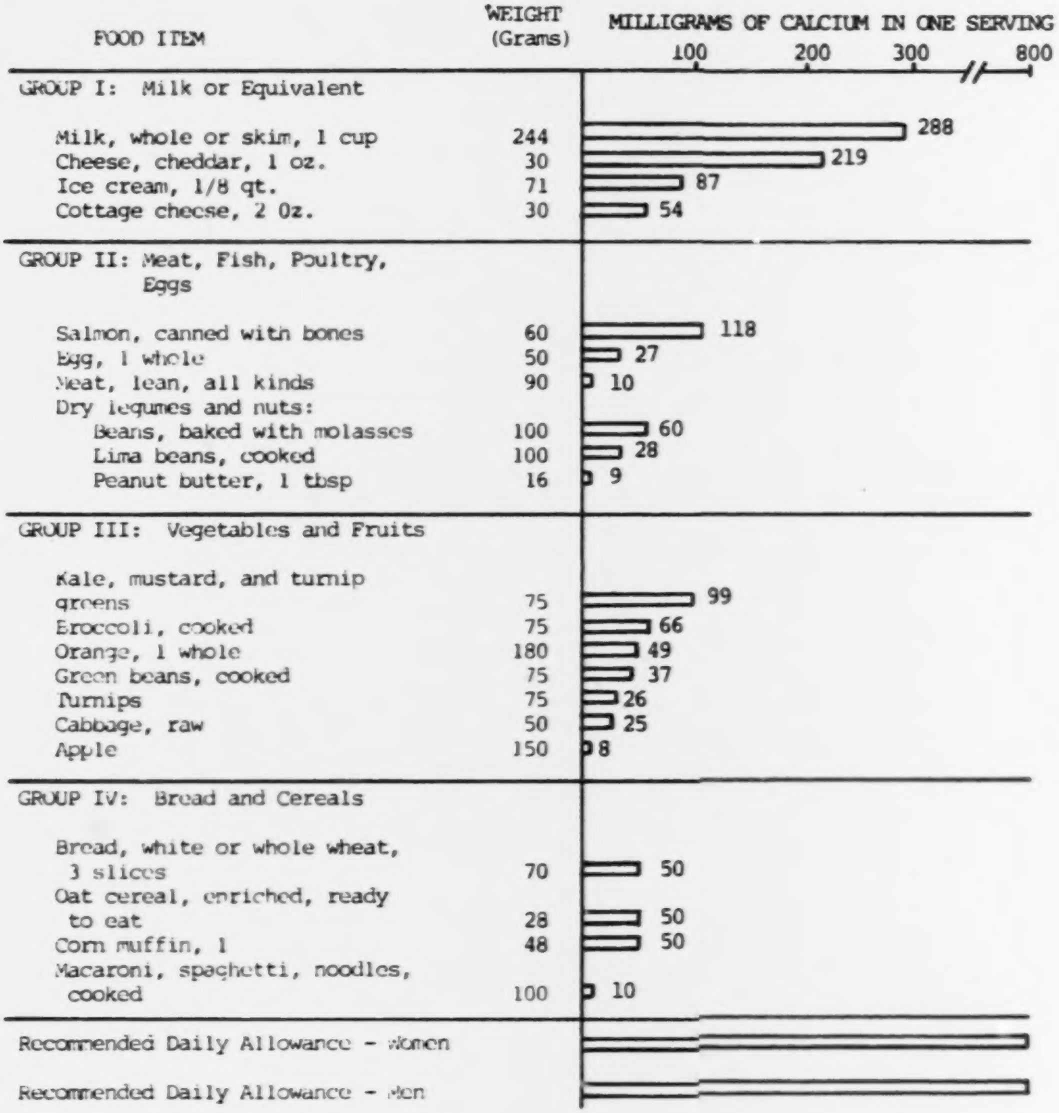


Figure 3-4. Amounts of calcium in various foods.

Phosphorus is the second most abundant mineral of the body.

Functions. Phosphorus must be present with calcium for the building of proper bones and teeth. It is an integral part of the cell structure and, therefore, is important in cell movement and multiplication. Phosphorus also plays a role in the metabolism of carbohydrates and fats.

Dietary allowances. Calcium and phosphorus are equally important in the diet, and the *Recommended Dietary Allowances* lists the phosphorus requirement as 0.8 grams for both the average man and woman. Phosphorus is more widely distributed and less likely to be deficient in the average diet than calcium. Diets that contain an adequate amount of protein and calcium are assumed to be adequate in phosphorus. Generally, the phosphorus allowance should be at least equal to the calcium allowance. This is especially true for children (except infants) and for pregnant and lactating women.

Food sources. Excellent food sources of phosphorus are milk, cheese, egg yolk, fish, fowl, fruits, green vegetables, and whole grain cereals.

Exercises (669):

1. Phosphorus is an integral part of cell structure and therefore, is concerned in cell ______ and ______ .

2. Phosphorus also plays a role in the metabolism of ______ and ______

3. Diets that contain an adequate amount of ______ and _______ are assumed to be adequate in phosphorus.

4. Excellent food sources for phosphorus are egg _____ and _____ _____ cereals.

670. Cite the two functions of iron, and list four bodily requirements for the intake of iron.

Iron. The total amount of iron present in the body is small, but, like calcium, iron is likely to be low in the American diet. The richest source of iron is liver, which, because it is unpopular, is often omitted from the diet. To obtain sufficient amounts of iron from other food sources requires careful diet planning.

Functions. More than half of the body's iron is in the hemoglobin of the circulating blood and in the hemoglobin of the muscles. The remaining iron is stored in the liver, bone marrow, kidneys, and spleen. Iron is a very necessary part of hemoglobin. The presence of iron allows hemoglobin to transport oxygen from the lungs to the body tissues. Iron also allows the hemoglobin to carry carbon dioxide back to the lungs. So, in a way, iron is essential for proper respiration.

Dietary allowances. The body is economical in its use of iron. The liver or spleen breaks down wornout hemoglobin cells and stores iron for future use. Therefore, the excretion of iron alone is extremely small. Iron is lost mainly when hemoglobin is lost from the body. Hemoglobin is lost during disease or injury when hemorrhage takes place and during normal menstruation.

The fact that the body uses iron over and over again does not lessen the need for it. Iron is needed: (1) by growing children to meet their expanding blood supply; (2) to balance losses occurring during menstruation; (3) during pregnancy and lactation to meet the needs of the developing infant; and (4) to build a reserve supply of iron, which can be used during sudden hemorrhaging or other blood loss.

Since menstruation causes some iron loss, the recommended iron allowance for young women is much higher than for men. During growth, the iron requirement for both boys and girls remain high.

Exercises (670):

1. What are the two functions of iron?

2. What are the four requirements for iron?

671. Describe the appearance of red blood cells in iron deficiency anemia, and specify the foods that are sources of iron and that prevent anemia in infants.

Deficiency symptoms. Anemia occurs when the body is deficient in iron. In iron-deficiency anemia, red blood cells appear light in color and smaller than normal, because hemoglobin is lacking. Remember that hemoglobin is the factor that carries oxygen to all body tissues. Since the body cannot synthesize hemoglobin without iron, the body cells do not receive adequate oxygen for energy metabolism. Extreme tiredness and weakness result.

Food sources. Since starting the program for the enrichment of cereal and bread products, low iron intake is less of a problem. The more expensive food sources of iron can now be supplemented considerably by the use of enriched cereals and breads.

Figure 3-5 shows the amounts of iron present in different foods. Animals store excess iron in the liver, making liver the most valuable food source of iron. Other food sources rich in iron are meats, poultry, fish, egg yolk, molasses, whole-grain or enriched cereals and breads, and green or yellow vegetables. Notice that milk, often thought to be a source of all nutrients, contains very little iron. For this reason, infants subsisting on milk alone can develop anemia if they have not stored iron before birth. Early use of egg yolks, vegetables, meat purees, and fortified cereals are recommended to prevent anemia in infants.

Exercises (671):

1. What is the appearance of red blood cells in iron deficiency anemia?

2. How can the more expensive food sources of iron be supplemented?

3. What is the most valuable food source of iron?

4. What foods are recommended to prevent anemia in infants?

672. Specify the importance of iodine in the diet.

Iodine. For many centuries, the residue of burned sea sponges was used in the treatment of the disease "goiter" (enlarged thyroid gland). Surprisingly enough, this was a

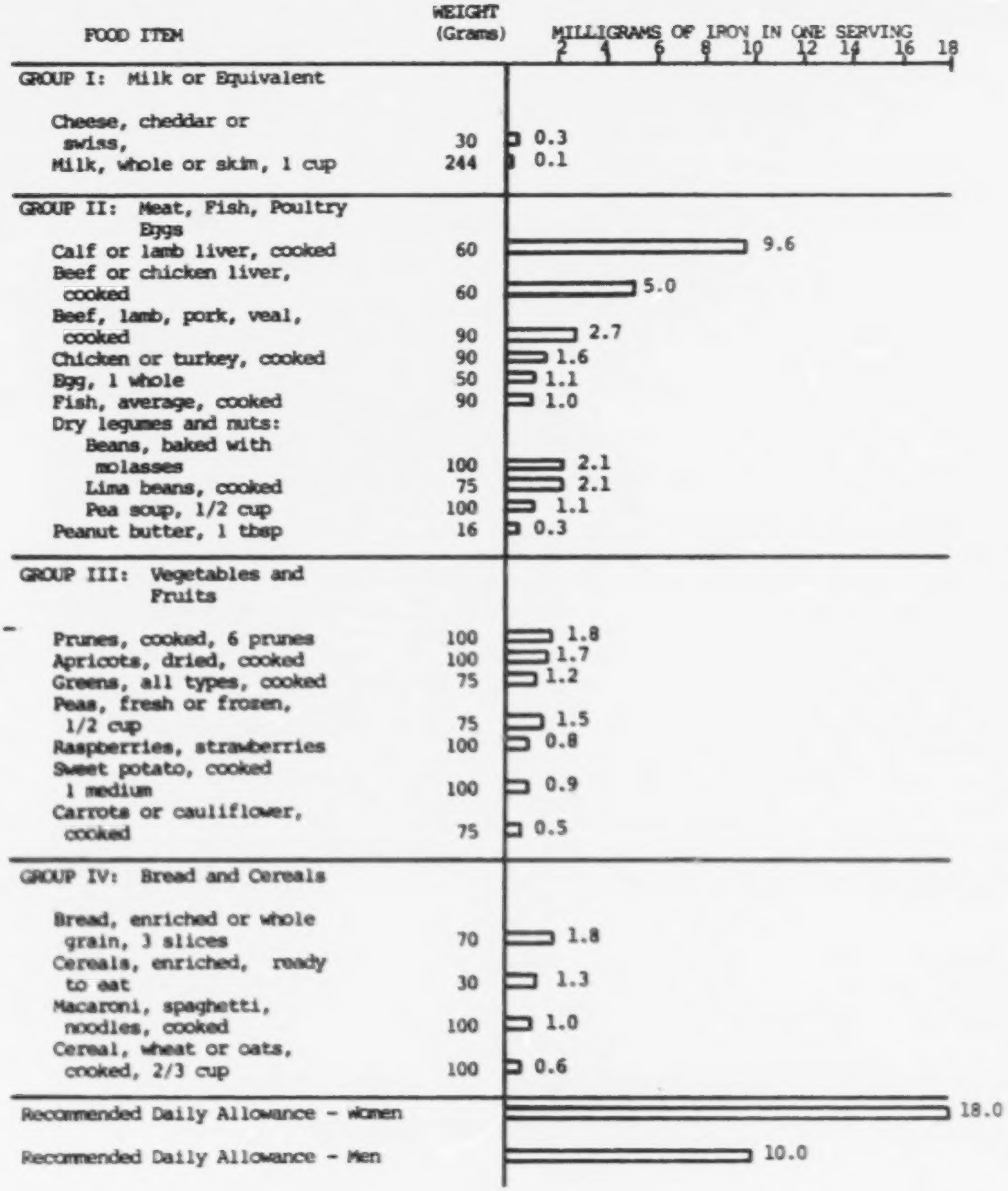


Figure 3-5. Amounts of iron in various foods.

very effective medication. In 1895, iodine, which is abundant in sea life, was discovered to be also present in the thyroid gland, and established later as essential for normal thyroid activity.

Functions. Iodine combines with the amino acid, thyrosine, to form thyroxine, which controls the functions of the thyroid gland. This gland regulates energy metabolism in the body. It stimulates the growth and development of the brain, bones, hair, and skin. It is essential for sexual development during adolescence and also promotes an adequate milk supply during lactation. As you can see, iodine is a very important mineral.

Dietary allowances. The adult's iodine recommended dietary allowance is 130 μg (μg = microgram, which is one millionth of a gram) for the average man and 100 μg for the average woman.

Deficiency symptoms. Insufficient levels of dietary iodine produce goiter. In goiter, the thyroid gland becomes enlarged because of an increase of structural gland tissue, though there is a decrease in actual thyroxine-secreting tissue. The whole body suffers from the lack of this essential hormone. Goiter can be readily observed because the neck is distorted because of the thyroid gland enlargement.

Food sources. Most food composition tables do not list the iodine content because the amount of iodine present in foods is difficult to determine accurately. Iodine is hard to measure because food sources contain such small amounts, and the amount of iodine in the soil can differ considerably from one area to another. The amount of iodine in the soil directly affects the amount of iodine in the food grown in the soil. Seafood is a good source of iodine, but may not always be available. Also, some people seldom eat seafood. Therefore, another method has been developed to ensure an adequate intake of iodine. Salt "iodized" with 1 percent iodine is now available. The iodine addition does not affect the taste or expense of the salt and is not harmful in any way. Today, the use of "iodized" salt is universally recommended for the prevention of goiter.

Exercises (672):

1. What is the function of iodine combined with thyrosine?

2. Give the recommended dietary allowance of iodine for the average woman.

3. What is the result of insufficient levels of dietary iodine?

4. How can you recognize an iodine deficiency?

5. What method has been developed to ensure an adequate intake of iodine?

673. List the major and minor bodily functions of sodium, its recommended daily allowance, and its chief food source.

Sodium. Sodium is widespread in nature, often combined with a chloride to form sodium chloride, which is common table salt. Most of the sodium in the body appears in blood plasma and in extracellular fluid, the fluid that bathes the tissues.

Functions. Sodium primarily maintains the proper water balance within the body. It also maintains normal muscle response to stimulation.

Dietary allowances. Normally, the amount of sodium in the body is kept within narrow limits. Sodium is regulated and excreted mainly through the kidneys, although considerable amounts may be excreted in feces and in perspiration. The retention of water (edema), which causes swelling and appears first in the ankles and wrists, is the result of an excess of sodium in the body. Loss of appetite, abdominal cramps, leg cramps, and dehydration are the results of sodium depletion.

The daily diet usually contains from 2 to 6 grams of sodium. This is a liberal allowance in most conditions. If an individual perspires heavily during extremely hot weather, he or she may require additional salt. Years ago, the military dispensed salt tablets to its personnel during the summer months. This practice no longer continues, except in extremely hot climates. In temperate climates, salt tablets should be taken only upon a physician's order. On the other hand, in the treatment for certain kidney and cardiac diseases, the normal sodium intake is usually reduced. In these diseases, the body retains abnormal amounts of sodium instead of excreting it.

Food sources. Sodium is the most widely found mineral in nature. The chief food source is table salt, but many other foods are also high in sodium. Some of these are milk, cheese, eggs, meat, seafoods, and vegetables, such as celery and spinach.

Exercises (673):

1. What is the major function of sodium?

2. What is the other function of sodium?

3. How much sodium does the daily diet usually contain?

4. What is the chief food source of sodium?

674. State the functions of potassium in the body, cite the estimated daily requirement and the sources of potassium, and briefly explain why a dietary deficiency is unlikely.

Potassium. Like sodium, potassium combines with a chloride to form a salt, potassium chloride. However, this mineral differs from sodium, because it is found principally inside the cells of body tissues.

Functions. Potassium chloride, found within the body cells and sodium chloride located outside the cells, function together to maintain a proper balance between the cellular and extracellular fluids. Potassium is important in cell metabolism, enzyme reactions, and the building of muscle protein from amino acids in the blood. A small amount of potassium is needed in the extracellular fluid for normal muscular activity.

Dietary allowances. The body's potassium requirement is estimated at 4 grams daily. A potassium deficiency is very unlikely, because it is found widely in natural plant foods.

Food sources. Milk, milk products, nuts, and many fruits and vegetables are rich sources of potassium.

Exercises (674):

1. What is the function of potassium chloride?

2. In what processes does potassium play an important part?

3. What is the body's estimated daily requirement for potassuim?

4. Why is a deficiency of potassium very unlikely?

5. Name five rich sources of potassium.

675. Identify by function and source the 11 other minerals found in the body.

Other Minerals Found in the Body. There are 11 other essential minerals in the body: chlorine, sulfur, magnesium, fluorine, copper, cobalt, manganese, zinc, molybdenum, chromium, and selenium. Of these minerals, recommended dietary allowances have been established only for magnesium and zinc. Since chlorine and sulfur are widely distributed, authorities feel that sufficient amounts of these two minerals are always present in the body. The remaining minerals, which are present in smaller quantities, are sometimes known as "micronutrients." Under normal circumstances, an adequate amount of most of these minerals is met by a diet providing the other nutrients recommended in the dietary allowances. Let us examine the roles that some of these minerals play.

Chlorine. Chlorine, combined with potassium, is present in the body tissue cells, and is combined with sodium in the extracellular fluids (fluids outside the cells). During digestion, chlorine is used in the formation of hydrochloric acid, the gastric acid of the stomach. The body's need for chlorine is easily met by natural foods and table salt.

Magnesium. Magnesium is possibly involved with carbohydrate metabolism in muscle tissues. It is also essential in cell formation and normal growth. The recommended daily allowance is 350 mg for the average man and 300 mg for the average woman.

Sulfur. If the protein intake is adequate, the sulfur intake is usually sufficient. Sulfur is present in some of the amino acids, insulin, thiamine and other compounds.

Copper. Copper is essential for the use of iron in the formation of hemoglobin. It is also a constituent of many enzymes that function in tissue metabolism. Copper may play a part in bone formation and nervous system functions. Humans rarely have a copper deficiency. It appears that a daily intake of approximately 2 mg of copper is adequate for normal health. Copper is widely distributed in even mediocre foodstuffs.

Cobalt. Vitamin B_{12}, a factor needed in red blood cell formation, contains cobalt. Ample cobalt is present in the average diet.

Flourine. A normal part of bones and teeth, fluorine is essential for the development of dental enamel. Water is the most practical food source of fluorine, though amounts of fluorine vary considerably in different geographical areas. If the fluorine content is very low, dental decay becomes a problem. Research and practice have shown that adding the proper amount of fluorine to drinking water, safely and effectively reduces the incidence of dental decay.

Zinc. Zinc combines with insulin to store hormones. The recommended dietary allowance for everybody is 15 mg. Zinc is widely distributed in foodstuff, with liver and seafoods the most valuable sources.

Exercises (675):

1. Match the function in column B with the appropriate mineral in column A.

Column A	*Column B*
____ (1) Chlorine.	a. Essential in the development of dental enamel.
____ (2) Magnesium.	
____ (3) Sulfur.	b. Vitamin B_{12} contains this mineral.
____ (4) Copper.	
____ (5) Cobalt.	c. Some of this mineral is used for the formation of hydrochloric acid.
____ (6) Fluorine.	
____ (7) Zinc.	

Column A	*Column B*
	d. This mineral occurs in compounds of some of the amino acids, insulin, and thiamine.
	e. Believed to be involved with carbohydrate metabolism in muscle tissues.
	f. Essential for the use of iron in the formation of hemoglobin.
	g. Combines with insulin to store hormones.

3-6. Vitamins

Interest in vitamins has benefited thousands of individuals. Vitamins perform specific and vital functions in the body. They occur in natural plant and animal tissues in very small quantities. Vitamins allow the body to use the essential nutrients effectively.

We will first discuss the vitamins that dissolve in fatty substances. These fat-soluable vitamins are carried throughout the body by the fatty acids. We will also discuss water-soluble (dissolved by water) vitamins. Vitamins A, D, E, and K are fat-soluble vitamins; ascorbic acid and the vitamin B complex group are water-soluble.

676. Specify the role of vitamin A in the diet.

Vitamin A. Vitamin A occurs in the natural state only in foods from animal sources, such as milk, butter, liver, and egg yolk. The source of all vitamin A is plant carotenes. Animals, humans included, convert portions of these vegetable carotenes into vitamin A. This is why green and yellow vegetables are listed as food sources for vitamin A.

Functions. Vitamin A is necessary for the building and growth of all cells. It is also important for bone and normal tooth structure. Vitamin A is present in the eye and is necessary for its proper function and maintenance, and for the mucous secretions of the membranes lining the nose, throat, and other air passages, the alimentary canal, and genito-urinary tracts.

Dietary allowances. The recommended dietary allowance of vitamin A for the average adult male is 5,000 I.U. (international units), and for women, 4,000 I.U. This amount is approximately double the minimum requirement for vitamin A, received entirely from animal food sources. It is assumed, however, that over half of the vitamin is supplied by carotene from plant sources, and only one-third is available from animal sources, in the average diet. This allowance ensures that an adequate quantity of vitamin A is normally converted from carotenes in the body. Additional amounts of vitamin A are required during pregnancy and lactation.

Deficiency or excess effect. A deficiency of vitamin A is due to an inadequate intake, or to disorders involving fat absorption and metabolism. The first sign of vitamin A deficiency is night blindness, an inability to adjust to dim light or to the glare of lights or sunlight. A deficiency can lead to the shrinking, hardening, and progressive breakdown of the cells of the eye, nasal passages, sinuses, middle ear, and lungs. These changes increase the chance of severe infection. Rough, dry, scaly skin may also indicate a vitamin A deficiency.

Very high overdoses of vitamin A can be harmful. These overdoses usually occur in children who receive massive doses of a vitamin A supplement. Symptoms include loss of appetite, dry and itching skin, loss of hair, and pain in the long bones.

Food sources. Fish-liver oils are the richest natural sources of vitamin A, though we usually consider them as supplements rather than food. Figure 3–6 lists important food sources of vitamin A. The animal sources, such as liver, milk fat products, and egg yolk, contain true vitamin A; fruits and vegetables contain carotene, a precursor of vitamin A. Menus that contain both animal and plant food sources help ensure an adequate intake of vitamin A.

Exercises (676):

1. Vitamin A is necessary for the ______ and ______ of all cells.

2. The recommended dietary allowance of vitamin A for the average adult male is __________ I.U.

3. Additional amounts of vitamin A are required during ______ and ______ .

4. The first sign of vitamin A deficiency is ______ ______ , an inability to adjust to ______ ______ or to the ______ of lights or sunlight.

5. The symptoms of an overdose of vitamin A include loss of _______ , dry and _______ skin, loss of hair, and pain in the _______ _______ .

6. _______ _______ oils are the richest natural sources of vitamin A.

7. Fruits and vegetables contain _______ , a precursor of vitamin A.

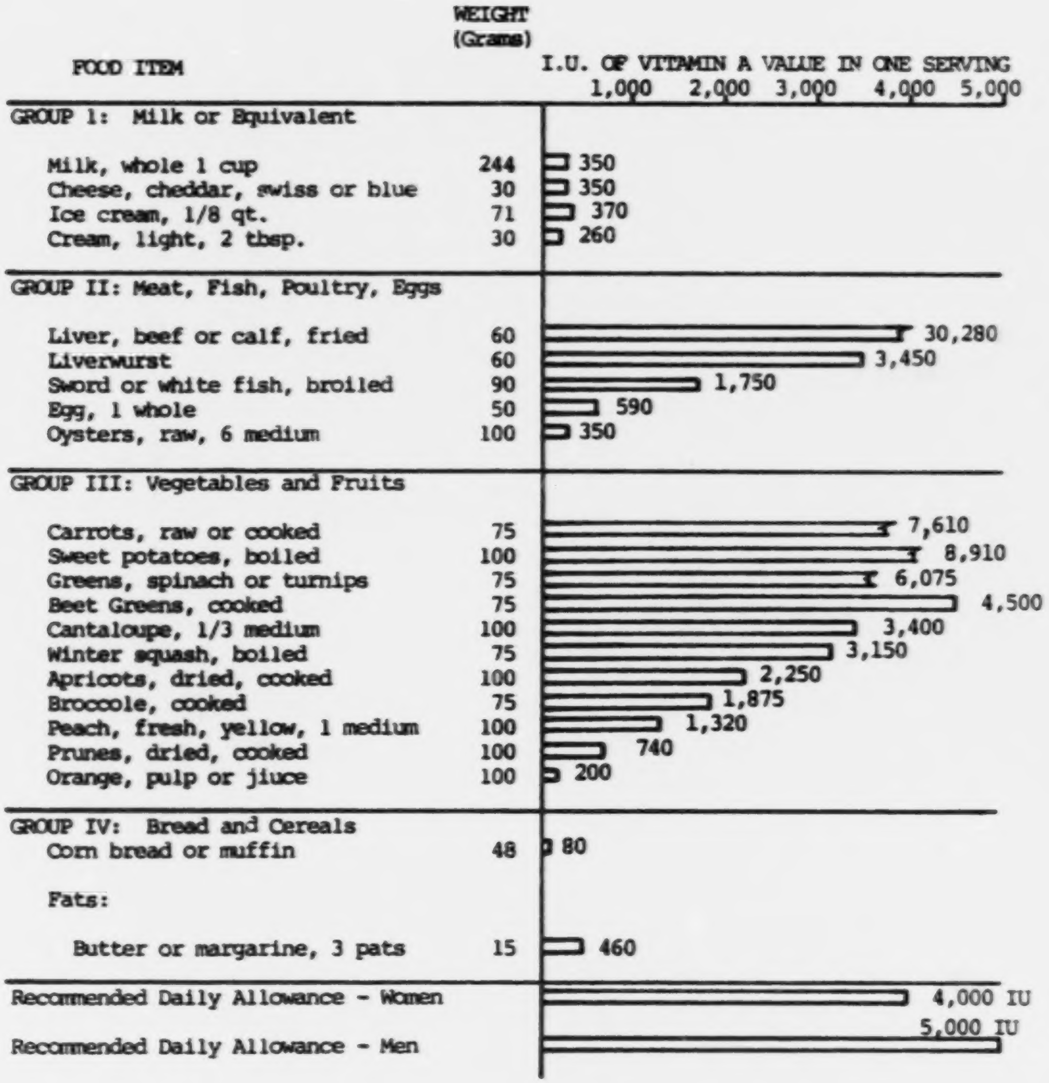


Figure 3–6. Sources of vitamin A.

677. Specify whether each statement about vitamin D is correct or incorrect.

Vitamin D. For years, vitamin D has been known as the "sunshine" vitamin because the body can manufacture vitamin D when the skin is exposed to the ultraviolet rays of the sun.

Functions. Vitamin D is needed in the depositing of calcium and phosphorus in the bones and teeth. However, an optimal intake of vitamin D does not reduce the body's need for calcium; it only assists in the proper use of calcium.

Dietary allowances. Although there is evidence that vitamin D is needed throughout the entire growing period, including the "teen" years, the actual requirement is not known. One reason for this is that the dietary intake requirement depends upon variables, such as the rate of growth and the amount of exposure to sunlight. The *Recommended Dietary Allowances* lists 400 I.U. daily during growth and development periods. Though allowances are not given for adults, many authorities believe that some vitamin D is advisable for most people, especially elderly persons.

Deficiency or excess effect. A lack of vitamin D leads to rickets in children. Rickets is usually not fatal, but the results can be very severe. For example, rickets occurs when calcium is not deposited in the bones for proper hardness. Therefore, the bones become fragile and deformed. In adults, osteomalacia (adult rickets) sometimes occurs from a deficiency of vitamin D or calcium (or both) causing the bones to become fragile, painful, and easily fractured.

Toxic effects have resulted from the continuous intake of large dosages of vitamin D. This toxic action seems to exaggerate its physiologic effects, for example, in abnormal calcification of growing bone and certain soft tissues. Although an overdosage is very rare, the chance of hypervitaminosis D should discourage supplementing this vitamin on a self-prescribed basis.

Food sources. Although sunlight is the chief source of vitamin D, you cannot always depend upon sunlight to supply adequate ultraviolet rays. Fortified milk is the next best source of vitamin D. Milk is either exposed to ultraviolet rays to produce the natural vitamin D, or concentrates of the vitamin are added. Fortified milk contains 400 I.U. per quart. Therefore, 1 quart a day supplies the recommended allowance during growth. Other foods such as egg yolk, liver, and some fish contain small amounts of vitamin D.

Exercises (677):

Indicate whether each of the following statements is correct or incorrect. Explain any incorrect statements.

T F 1. An optimal intake of vitamin D reduces the body's need for calcium.

T F 2. Vitamin D is needed throughout the entire growing period, but the actual requirement is not known.

T F 3. The *Recommended Dietary Allowance* lists 500 I.U. of vitamin D daily during growth and development periods.

T F 4. A lack of vitamin D leads to rickets in children.

T F 5. Toxic effects have resulted from the continuous intake of large dosages of vitamin D.

T F 6. Although sunlight is the chief source of vitamin D, fortified milk is the next best source.

678. Cite the place of vitamin E in the diet.

Vitamin E. Vitamin E is an essential nutrient in more than 20 animal species, including humans. Small amounts of vitamin E are stored in various organs, muscle, and adipose (fatty) tissue of the human body.

Functions. The functions of vitamin E are still being studied. One important function of vitamin E is its antioxidant properties. This means that vitamin E helps prevent the deterioration caused by oxidation in certain foodstuffs. Using this property, vitamin E protects carotene and vitamin A (both normally susceptible to oxidation) from destruction in the small intestine. Other foods, such as certain fatty acids, may also be protected from oxidation by vitamin E. This vitamin plays a role in the formation and lifespan of red blood cells. Studies show that vitamin E may influence the use of sex hormones, cholesterol, and vitamin D. As you can see, this vitamin appears to be involved in a variety of body processes. Continued research is necessary before all of its functions can be defined.

Dietary allowances. In 1968, the Food and Nutrition Board established recommended dietary allowances for vitamin E for the first time. A daily intake of 15 I.U. is recommended for the average man, and 12 I.U. for the average woman.

Deficiency effect. Since vitamin E is widely distributed in food, a deficiency can occur only when diets are grossly deficient in many other nutrients. In such a case, it is difficult to specify the impact of this deficiency. However, research studies on animals have shown that a vitamin E deficiency results in reproductive failure, a shorter lifespan of red blood cells, a reduced formation of red blood cells, and muscular disorders.

Food sources. Oils of wheat germ, cottonseed rice germ, and the germs of other seeds are potent sources of vitamin E. It is also widely distributed in dark-green leafy vegetables, nuts, and legumes.

Exercises (678):

1. What is one important function of vitamin E? Explain.

2. What is the recommended daily allowance of vitamin E for the average man?

3. When can a vitamin E deficiency occur?

4. What are the potent sources of vitamin E?

679. List the function of vitamin K, the organ with which it is associated, the dietary requirement, the result of vitamin K deficiency, and its sources.

Vitamin K. The last of the fat-soluble vitamins, vitamin K, was first discovered from studies conducted on animals. These studies showed that a specific vitamin was needed in normal blood clotting and could prevent fatal hemorrhages in chickens. It was termed "Koagulation Vitamin," shortened to vitamin K.

Functions. Vitamin K is needed in the formation of prothrombin, a part of normal blood. Prothrombin is essential for the blood to clot properly. The functions of vitamin K seem to depend upon proper liver functioning, since bile salts are needed for vitamin K absorption. Small amounts of stored vitamin K are usually found in the liver.

Dietary requirement. The exact required daily amount of vitamin K is not known, but 1 to 2 mg are possible adequate. A food deficiency of vitamin K is rare, but a deficiency can develop when the body fails to absorb or use this vitamin. Remember that mineral oil used as a laxative or in salad dressings can interfere with the absorption of vitamin K and all other fat-soluble vitamins.

Deficiency effect. Lack of sufficient vitamin K decreases blood prothrombin. This deficiency reduces the ability of blood to clot, prolongs the clotting time, and increases the possibility of hemorrhage in cases of injury. Vitamin K is often administered medically to reduce this danger.

Food sources. The green leaves of such vegetables as spinach, cabbage, kale, and cauliflower are excellent sources of vitamin K. Also, bacterial action in the intestines can synthesize vitamin K.

Exercises (679):

1. What is the most important function of vitamin K?

2. Upon the proper functioning of what organ do the functions of vitamin K depend?

3. What is probably an adequate daily intake of vitamin K?

4. How does a vitamin K deficiency affect the blood?

5. Name four vegetables that are excellent sources of vitamin K.

680. Cite the importance of vitamin C (ascorbic acid) in the diet.

Ascorbic Acid (Vitamin C). Ascorbic acid, commonly known as vitamin C, is the first water-soluble vitamin that we will discuss. Years ago, on long sea voyages when diets were low in citrus fruits and other foods rich in ascorbic acid, scurvy was common. Sailors developed swelling, infection, and bleeding of the gums (gingivitis), tenderness of the legs, and anemia. The teeth became loose and eventually fell out. The slightest injury produced bleeding, and pinpoint hemorrhages could be seen underneath the skin. Long before ascorbic acid was actually discovered, sailors recognized their need for citrus and other fresh fruits to prevent and cure scurvy. Today, research has assured our astronauts that their ascorbic acid needs are met when they are in space. Since ascorbic acid cannot be stored in the body, the diet must provide a daily supply.

Functions. The healthy development and maintenance of blood vessels, dentin of the teeth, bones, cartilage, and connective tissues all depend upon the function of ascorbic acid. This vitamin also increases the body's resistance to infection. It also appears to be important in its effect on amino acids and in certain vitamin metabolism.

Dietary allowances. The need for ascorbic acid cannot be overstated. Fairly small amounts can protect an adult from scurvy, but larger amounts are required to assure optimum health. The *Recommended Dietary Allowances* lists 45 mg of ascorbic acid for the average man and woman; and the Air Force dietary standards list 60 mg for the military man and woman. This amount should be increased during pregnancy, lactation, states of infection and fever, and after injury or surgery.

Deficiency effect. If there is a deficient supply of ascorbic acid in the body, gums become tender and bleed easily, joints swell and are painful, and muscles weaken. There is increased susceptibility to infection, growth retardation, and poor health in general.

Food sources. Raw, canned, and frozen citrus fruits, such as oranges, lemons, and grapefruits, are excellent sources of ascorbic acid. Figure 3-7 shows that strawberries, cantaloupe, broccoli, green peppers, and green leafy vegetables, such as mustard greens and cabbage, are also good sources. If eaten in large quantities, potatoes, apples, and turnips can be important sources of ascorbic acid.

Remember that ascorbic acid is the least stable of all the vitamins. Exposed to air or light, it oxidizes rapidly unless the food is citrus or another acid food. Alkalinity is very destructive to ascorbic acid; therefore, never add baking soda to vegetables during cooking. To reduce vitamin losses into the water, use only small amounts of water when cooking vegetables. High temperatures, too, are destructive, especially when foods are held for long periods on hot food tables.

Exercises (680):

1. Healthy development and maintenance of blood vessels, ______ of the teeth, and ______ tissues all depend upon the function of ascorbic acid.

2. Ascorbic acid also seems to be important in its effect on _____ acids and in certain vitamin _______ .

3. The Air Force dietary standards lists _____ mg of ascorbic acid for the military man and woman.

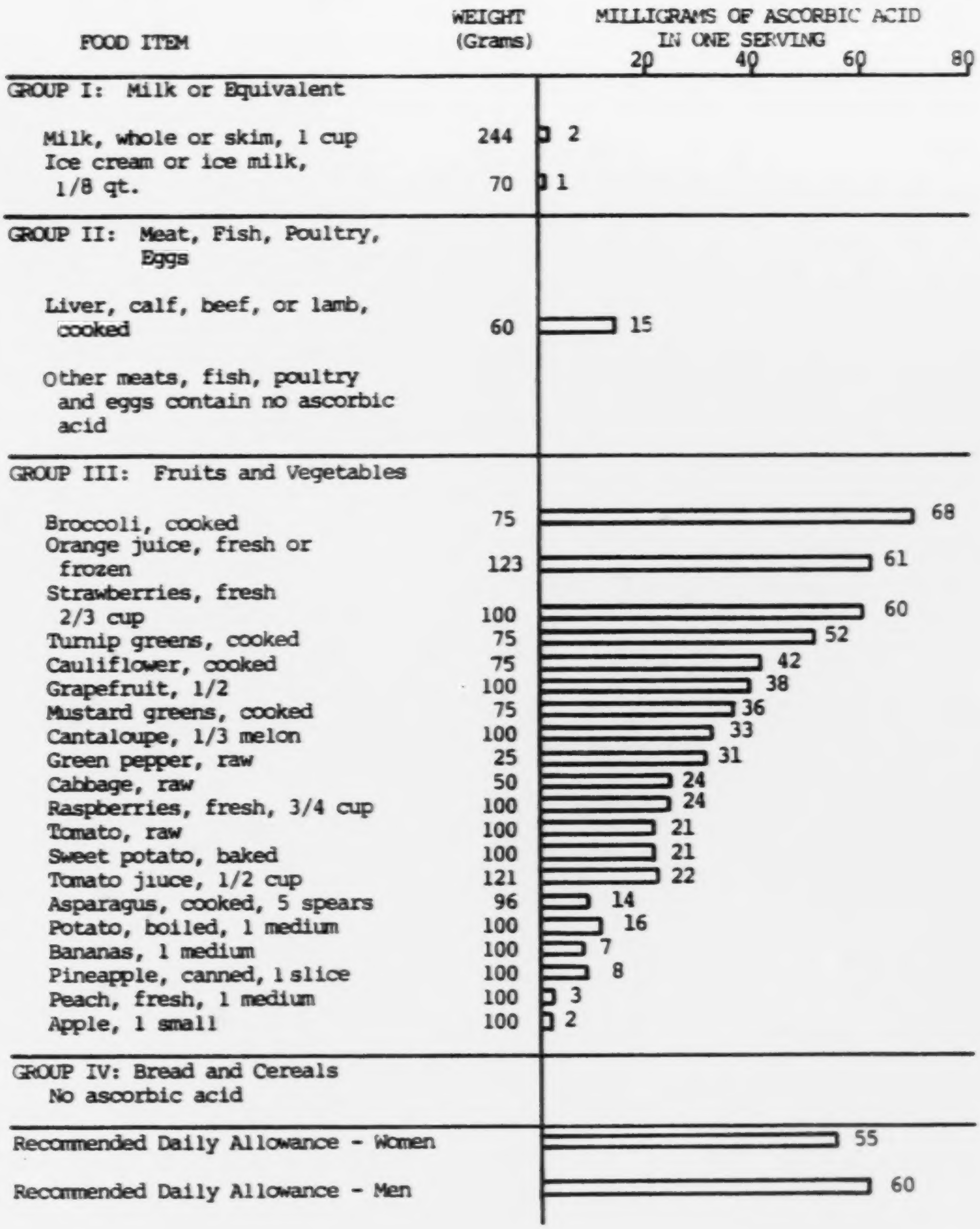


Figure 3-7. Sources of vitamin C.

4. When there is a deficient supply of ascorbic acid in the body, gums become _____ and _____ easily, joints _____ and are painful, and muscles ______ .

5. Raw, canned, or frozen ______ ______ are excellent sources of ascorbic acid.

6. If exposed to air or light, ascorbic acid will ______ rapidly unless the food is citrus or another acid food.

7. ______ is very destructive to ascorbic acid; therefore, never add baking soda to vegetables during cooking.

681. Cite the functions of thiamine in the diet, and its dietary allowances, deficiency effects, and food sources.

Thiamine (Vitamin B_1). Thiamine is a water-soluble vitamin in the vitamin B-complex group. The role of each B-complex vitamin is still not clear. However, it is certain that they are essential for proper metabolic changes in the cells. Many of them are involved with the breakdown of carbohydrate, protein, and fat in the body. At the present time, the recommended dietary allowances have been established for six vitamins of the group—thiamine, riboflavin, naicin (nicotinic acid), vitamin B_6, vitamin B_{12}, and folacin. We will discuss these six vitamins and add brief comments on other B-complex vitamins.

Functions. Thiamine is essential for certain enzyme actions in the metabolism of carbohydrate. Appetite seems related to this function, because a deficiency of thiamine can also produce a lack of appetite. When the thiamine deficiency is corrected, the appetite returns to normal. Thiamine is also needed for the maintenance of normal tone and mobility in the gastrointestinal tract. Normal heart action is related to an adequate thiamine intake. Thiamine has also been known as the "morale" vitamin because it is associated with the proper functioning of the nervous system in preventing irritability and depression.

Dietary allowances. Since thiamine is involved in energy metabolism, an adult's thiamine requirement is usually related to his or her caloric intake. For the average man, 1.4 mg of thiamine is the recommended dietary allowance, and 1.0 mg is recommended for the average woman. Variations in the thiamine requirement depends upon age, amount of physical activity, growth, pregnancy, and lactation.

Deficiency effects. A severe deficiency of thiamine causes beriberi. Some of the serious symptoms of this disease are disorders of the nervous system accompanied by edema and cardiac symptoms. Poor health in general can be caused by a deficiency of this vitamin before beriberi actually develops. Symptoms of a mild thiamine shortage include loss of appetite, fatigue, irritability, depression, gastric distress, and constipation.

Food sources. Grain products are the chief food source of thiamine in the United States. The cereal and flour enrichment program has helped to improve our dietary levels of thiamine. Lean pork and liver are also especially good sources of thiamine (fig. 3-8). Meats, poultry, fish, milk, fruits, and vegetables all contribute additional thiamine to the daily diet.

Exercises (681):

1. For what body function is thiamine essential?

2. Why is thiamine known as the "morale" vitamin?

3. To what is the thiamine requirement of an adult usually related?

4. On what do the variations in the thiamine requirement depend?

5. A severe deficiency of thiamine can cause what disease?

6. What are the symptoms of a mild thiamine shortage?

7. What is the chief source of thiamine in the United States?

682. Compare riboflavin with thiamine, and state the recommended daily allowance of riboflavin, its deficiency symptoms, and its sources.

Riboflavin. The second member of the B-complex group is riboflavin. It was first discovered in milk and then in other substances, such as liver, yeast, milk, heart, and egg whites.

Functions. Like thiamine, riboflavin is an essential part of a number of enzymes found in all living cells. It has a relationship to normal vision. Proper skin tone and digestion also depend upon adequate riboflavin intake.

Dietary allowances. The Food and Nutrition Board has recommended a daily riboflavin intake of 1.6 mg for men and 1.2 for women. However, remember that increased requirements for riboflavin occur during pregnancy,

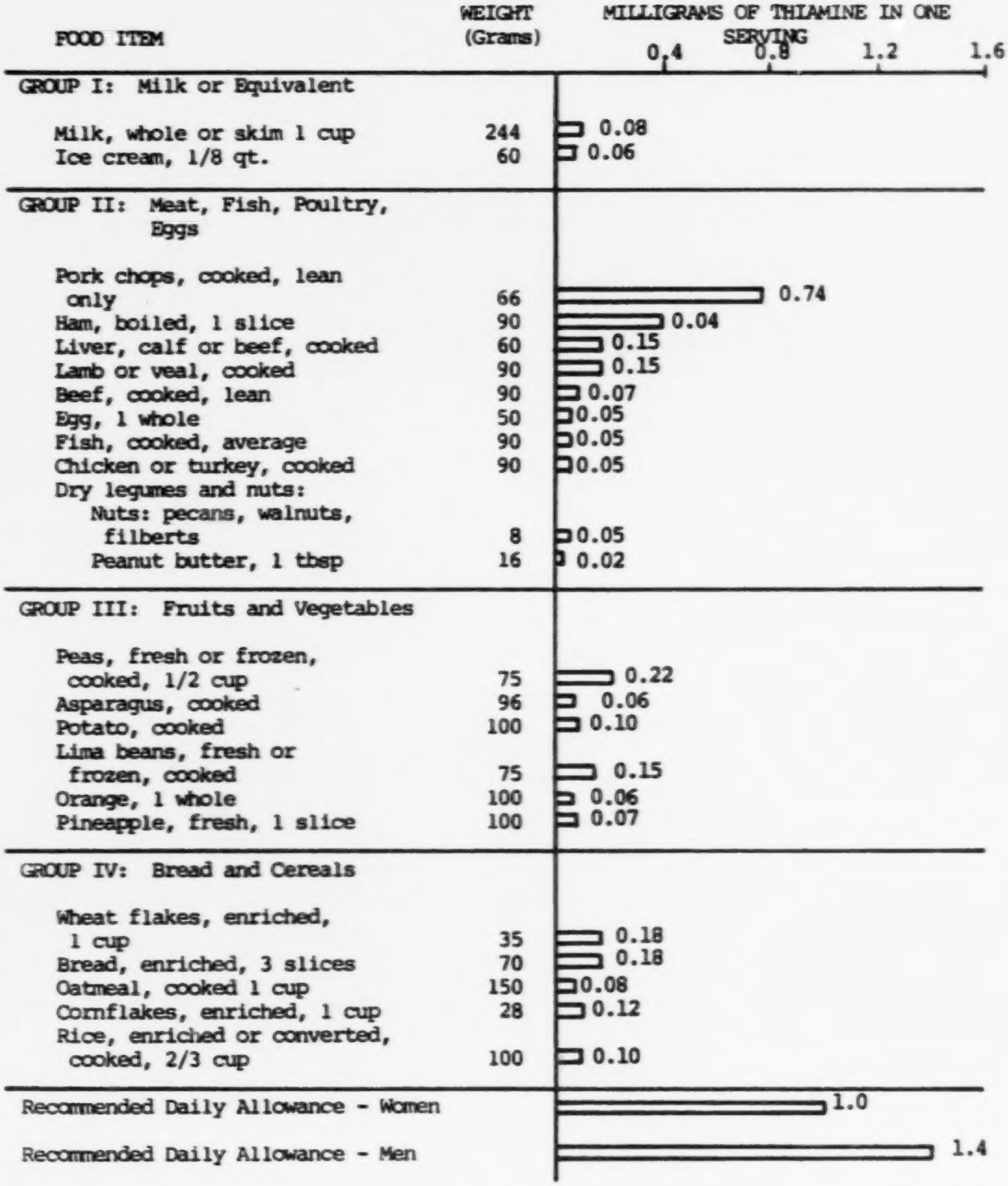


Figure 3-8. Sources of thiamine.

lactation, growth, hyperthyroidism, fevers, stress, diarrhea, and vomiting.

Deficiency effects. The normal metabolism of carbohydrates and proteins is disrupted by a lack of riboflavin. Skin changes, such as cracks in the corners of the mouth, inflammation of the lips and tongue, and scaliness around the nose and ears, occur. There may also be itching and burning of the eyes, blurred vision, and sensitivity to light.

Food sources. The best food sources of riboflavin include milk, cheese, and other dairy products, excluding butter. Liver contains a considerable amount of riboflavin. Meats, eggs, and leafy green vegetables contain smaller amounts (see fig. 3-9). Enriched cereals also contain significant amounts of this vitamin.

Milk is important to a diet which must include riboflavin. Processing and normal cooking will not reduce milk's riboflavin content; however, light will. If milk is allowed to stand exposed to light for any length of time, as much as three-fourths of the riboflavin may be lost.

Exercises (682):

1. Compare riboflavin with thiamine in its most important function.

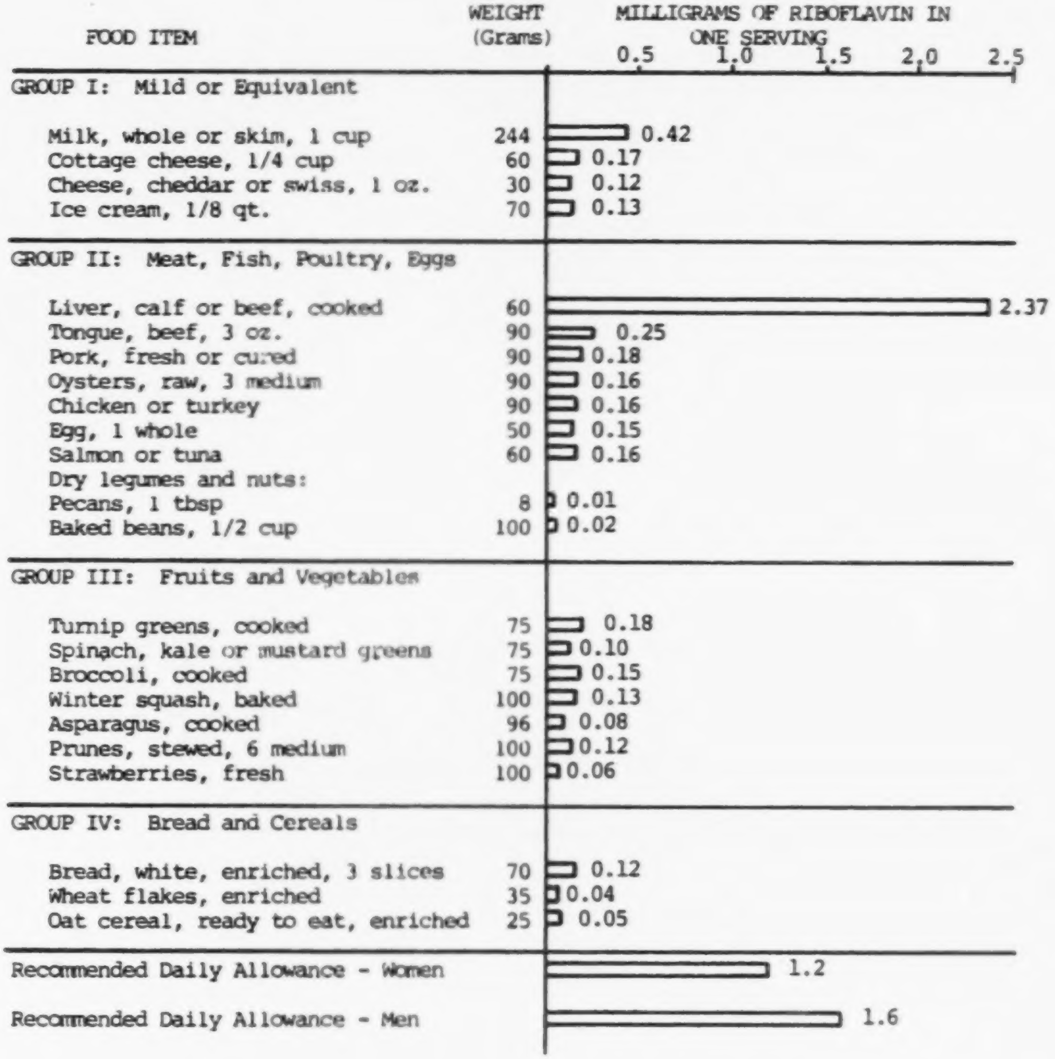


Figure 3-9. Sources of riboflavin.

2. What is the recommended daily riboflavin intake for men and women?

3. Describe the symptoms of riboflavin deficiency.

4. What are the best sources of riboflavin?

683. Cite the function niacin has in common with thiamine and riboflavin, and specify the dietary requirement, deficiency effects, and good as well as poor sources of niacin.

Niacin (Nicotinic Acid). Niacin was first discovered in its relation to the deficiency disease, pellagra. Gastrointestinal disturbances, skin eruptions, and nervous disorders characterize pellagra. At first, studies showed an improvement of pellagra after niacin was given. Today, however, an adequate supply of thiamine and riboflavin also is possibly needed to relieve all the symptoms of pellagra.

Niacin is readily absorbed from the small intestine. Some storage of niacin occurs in the body, but, like other B-complex vitamins, the amount seems small. Therefore, a daily intake of this vitamin is essential. An adequate protein intake can help to ensure that the niacin requirement is met, because one of the amino acids—tryptophan—is a precursor of niacin. If tryptophan is present, the body can synthesize niacin.

Functions. The action of niacin is similar to that of riboflavin. It is involved as a part of the enzymes in various intermediate breakdown products of the glucose molecule. Together with thiamine and riboflavin, niacin is essential for the release of energy.

Dietary allowances. All living organisms require niacin. Its exact needs in the body are not known. Since the function of niacin relates to the breakdown of carbohydrates, the need for it should probably be based on the carbohydrate value of the diet. The *Recommended Dietary Allowances* lists 18 mg of niacin daily for the average man and 13 mg of niacin for the average woman. As is true for the other B-complex vitamins, niacin intake should be increased during growth and stress periods, such as with fever, injury, or hyperthyroidism.

Deficiency or excess effects. When there is a niacin deficiency, none of the enzyme systems involved with carbohydrate metabolism can function properly. Changes also occur in the gastrointestinal tract, skin, and nervous system.

Doses of up to 5,000 times the normal daily intake of niacin are not toxic. However, doses beyond that amount have produced generalized paralysis and difficulty in respiration in animals.

Food sources. Meats, including poultry and fish, are the most important food sources of niacin in the daily diet (see fig. 3-10). Whole grains or enriched products are fair sources of niacin. In considering food sources of niacin, do not forget foods rich in tryptophan. Although milk and milk products are low in niacin, they are good pellagra-preventive foods, because they contain tryptophan. Potatoes, legumes, and some vegetables also contain fair amounts of niacin, but most fruits are poor sources.

Niacin is one of the most stable of the water-soluble vitamins. It is stable to alkali, acid, heat, and oxidation. Cooking, therefore, does not cause serious losses of niacin from foods, except for the vitamins discarded with the cooking water.

Exercises (683):

1. What is the value of niacin when it is combined with thiamine and riboflavin?

2. Niacin's requirement is based on what other element in the diet?

3. What happens to bodily organs when a niacin deficiency occurs?

4. What are the most important food sources of niacin?

5. What class of food is considered a poor source of niacin?

684. Identify miscellaneous B vitamins by matching each to its correct function.

Vitamin B_6 (Pyridoxine). The main function of pyridoxine is to aid the enzymes which participate in amino acid metabolism. Pyridoxine is also involved in the metabolism of fatty acids, and participates in the conversion of tryptophan to niacin. The recommended dietary allowance of 2.0 mg is provided by an ordinary diet. Good food sources include wheat germ, liver, kidney, meats, and whole grain cereals.

Pantothenic Acid. Pantothenic acid also plays an important part in basic energy metabolism. It is involved in the use of carbohydrate, and in the synthesis and breakdown of fatty acids and organic fat-like substances called sterols (for example, cholesterol).

A definite dietary requirement has not been established for pantothenic acid, but the average diet seems to provide liberal amounts of this vitamin. Good food sources include yeast, liver, kidney, salmon, eggs, pork, and wheat flours.

Vitamin B_{12} (Cyanocobalamine). Vitamin B_{12} is essential for the proper formation of red blood cells in the

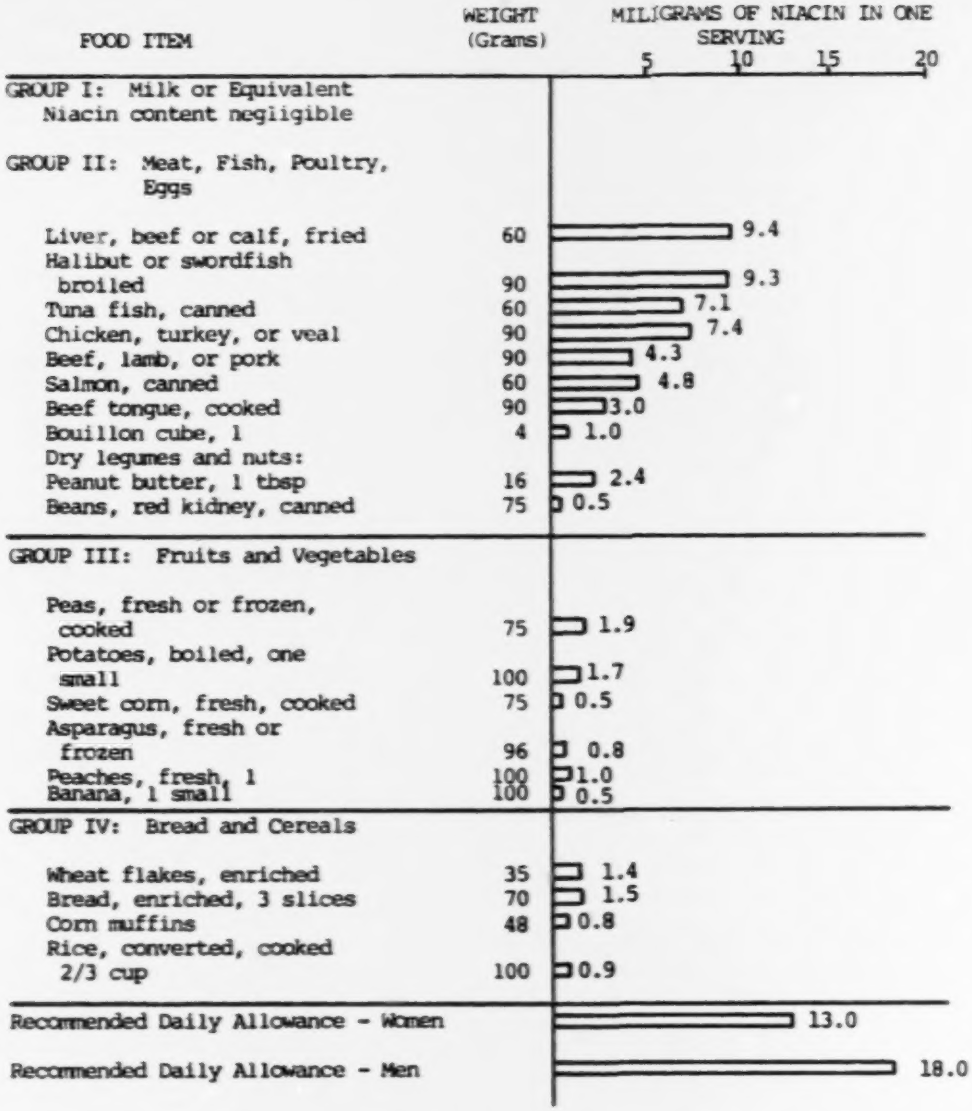


Figure 3–10. Sources of naicin.

bone marrow. Pernicious anemia, not to be confused with iron-deficiency anemia, results from a deficiency of vitamin B_{12}. In pernicious anemia, the bone marrow cannot produce new red blood cells fast enough to replace wornout cells. Vitamin B_{12} does not work alone in this function, and cannot be absorbed without the presence of a specific factor contained in the gastric juices of the stomach, termed the "intrinsic" factor. Vitamin B_{12} is termed the "extrinsic" factor because it must be supplied from outside the body by the diet. The recommended dietary allowance for vitamin B_{12} is established at 5.0 mg. It appears that meats and other animal products help to maintain a substantial dietary level of vitamin B_{12}.

Folacin (Folic Acid). Folacin is also needed in blood formation. However, vitamin B_{12} more effectively relieves the symptoms of pernicious anemia. Folacin seems to be involved in other body processes as well, such as amino acid metabolism, reproduction, and normal skin and hair growth. An allowance of 0.4 mg folacin is the recommended dietary level for the average adult. Ascorbic acid helps the body to absorb this vitamin. Folacin compounds are found in green leafy vegetables, liver, yeast, meats, nuts, legumes, and whole grains.

Exercises (684):

1. Match each vitamin listed in column A with its correct function in column B.

Column A	*Column B*
____ (1) Vitamin B_6.	a. Essential for proper formation of red blood cells in the bone marrow.
____ (2) Pantothenic acid.	
____ (3) Vitamin B_{12}.	
____ (4) Folacin.	

Column A	*Column B*
	b. Participates in the conversion of trypthophan to niacin.
	c. Involved in reproduction and normal skin and hair growth.
	d. Involved in the synthesis and breakdown of fatty acids and sterols.

3-7. Water

Water is the most important item in the diet. An individual can live for weeks without food, but will die in a few days if deprived of water. Over 50 percent of the total body weight is water. Fluid within the cells accounts for 75 percent of the total water weight. Circulating plasma and extracellular fluids account for the remaining 25 percent.

685. Cite the functions of water in the body and its sources.

Functions. Chemical changes in the cells of the body take place in the presence of water. It is the basis of body fluids, secretions, and excretions, such as blood, lymph, gastric juices, bile, perspiration, and urine. Water holds the products of digestion in solution and allows them to be absorbed through the intestinal walls into the bloodstream. Water constitutes about 90 percent of the blood, enabling it to carry nutritive elements to the cells, carbon dioxide to the lungs, and waste material to the kidneys. Urine consists of about 97 percent water, holding wastes in solution. Sufficient water must also be present in the bowel wastes to avoid constipation.

Water is also an important lubrication in the body, for it prevents friction between moving body parts. Evaporation emitted from the skin and lungs helps to regulate body temperature.

Sources. The body obtains water in three different ways. The first, and obvious, way is drinking it. The body also obtains water from various foods. All foods, even those considered to be dry, contain significant amounts of water. An egg, for example, is approximately 75 percent water, and meats may also contain as much as 75 percent water.

The third way the body obtains water is from the oxidation of food in the body. The end products of energy metabolism are carbon dioxide and water. The metabolism of an average diet yields approximately 300 to 500 ml of water daily.

Although the body uses water conservatively, it loses considerable amounts daily. The normal kidney is able to filter about 180 liters of water daily, reabsorbing 99 percent into the bloodstream; the remaining 1,000 to 2,000 ml are excreted daily.

The volume of water contained in the daily secretions of saliva, gastric juice, bile, pancreatic juice, and intestinal juice is approximately 7,500 ml. When digestion is completed, the water from these secretions is reabsorbed into the blood, though some water is lost in the bowel excretion.

Water is constantly evaporated from the skin and lungs. During moderate activity in a moderate climate, the normal water loss from evaporation is approximately 1,000 ml daily. A large person can lose as much as 15 liters in 1 day during heavy activity in hot climates.

Exercises (685):

1. ______ changes occurring in the cells of the body take place in the presence of water.

2. Water holds the products of ______ in solution and allows them to be absorbed through the intestinal walls into the bloodstream.

3. Water enables the blood to carry ______ elements to the cells, ______ ______ to the lungs, and ______ ______ to the kidneys.

4. What helps to regulate body temperature through ______ from the skin and lungs.

5. An egg is approximately ______ percent water.

6. The body obtains water from the ______ of food in the body.

686. Define "a state of water balance," and explain ways of maintaining it in the body.

Water Balance. Dehydration (loss of water) can be fatal. We cannot overemphasize the importance of keeping the body in fluid balance. The body is said to be in a state of water balance when the amount of water it takes in equals the amount of water it emits.

Excess amounts of water can be lost during prolonged vomiting, hemorrhage, prolonged diarrhea, fever, excessive perspiration, burns, and uncontrolled diabetes. Less-than-fatal losses of water may lead to poor food absorption, vomiting, diarrhea, fever, circulatory failure, kidney failure, and intestinal obstruction.

Abnormal water loss must be replaced. Consuming beverages, broths, and ice is one way to replace the body's water. In severe illness or following surgery, the patient often requires intravenous saline and/or glucose solutions.

Daily Allowances. Normally, the recommended human intake of water is 1,440 to 1,920 ml (6 to 8 cups) per day in the form of drinking water or beverages. Patients often require additional fluid to compensate for the abnormal water loss in the various disorders we have discussed.

Exercises (686):

1. When is the body in "a state of water balance?"

2. Following surgery, what is a patient given to replace an abnormal loss of water?

3. Cite the recommended human intake of water per day.

3-8. Fiber

The term "fiber" is used to identify all the indigestible carbohydrates found in plant foods. Frequently, they are referred to as cellulose, roughage, or bulk. Since these carbohydrates are indigestible, they are not considered as a source of energy. Unlike vitamins and minerals, they do not enter into essential chemical reactions or cause such reactions to occur. Though they are not considered as nutrients or foods, they do have an important function in the body—stimulating normal activity in the large intestine.

687. Cite the function of fiber in the diet, list the effects of an excess of fiber, and specify the type of diet that ordinarily contains a sufficient amount.

Function. You already know that peristaltic action is the automatic, rhythmic waves that force food through the gastrointestinal tract. However, much of the food we eat is digested and absorbed, leaving only a small amount of residue in the intestine, offering little stimulation for peristaltic movement of the intestines.

The chief function of fiber is to provide bulk to stimulate the peristaltic action, which causes waste products to pass down the intestinal tract at a normal rate of speed. Fiber is important for good elimination and helps to prevent constipation. It absorbs moisture and increases in size. This water absorption prevents the fecal mass from becoming hard, dry, and difficult to excrete.

Although fiber does not undergo a chemical change in the body, tough fibers, such as fruit skins and the outer coating of cereal grains, are softened by gastric acid. They are not dissolved but are broken into smaller pieces by the digestive juices and the muscular contractions of the stomach and intestines.

Excess fiber delays the emptying time of the stomach, increases the flow of gastric acid, and irritates the walls of the stomach and intestines. The fiber of cooked foods is softer and partially broken down, and absorbs less water during digestion. In certain diseases, the fiber's action must be reduced, and only cooked fruits and vegetables should be included in the patient's diet.

Dietary Allowances. The amount of fiber needed for normal bowel movement varies considerably. During constipation, an extra amount of fiber is required.

An average mixed diet, which includes leafy vegetables, fruits, and whole grain breads and cereals, usually contains the necessary amount of fiber. Straight bran is sometimes used to correct constipation, but increasing the fiber intake with fresh fruits and vegetables and whole grain breads and cereals is more advisable. Sufficient bulk is obtained without irritating the colon.

Exercises (687):

1. What is the chief function of fiber?

2. What may happen if there is an excess of fiber?

3. What are the items in an average mixed diet that usally contain the necessary amount of fiber?

3-9. Daily Food Guide System

You have learned the classes of nutrients that the body needs for the living processes, maintenance, repair, and growth or development. A diet that supplies these nutrients in the proper quantities is an adequate or balanced diet.

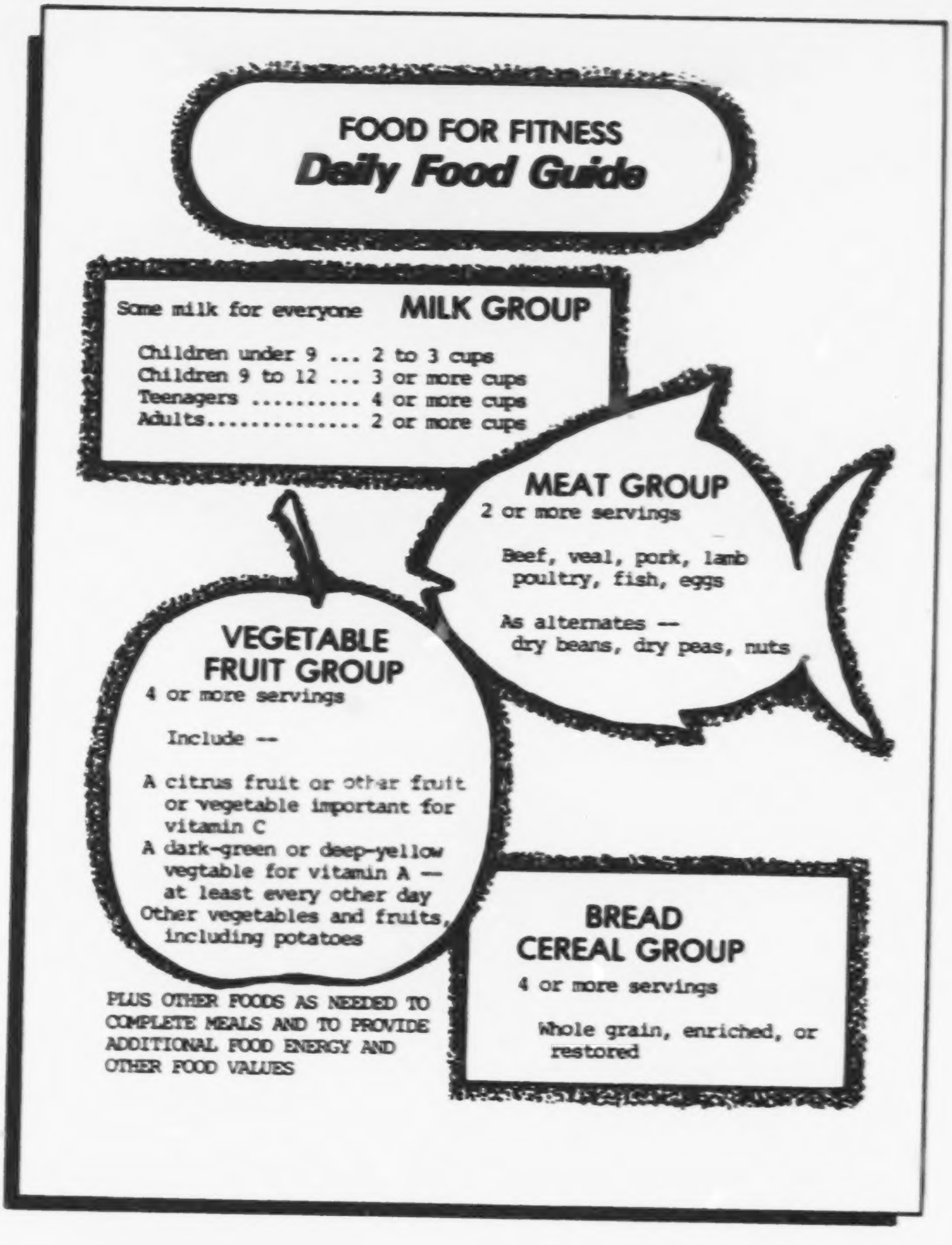
A Daily Food Guide has been developed to provide a reliable, short-cut system of nutritional evaluation. It is an easy, practical, and common sense guide for selecting the right foods. As you can see figure 3-11, the Daily Food Guide, contains four good groups. Foods were chosen for each group because of their significant content of essential nutrients. Each group in the guide has a special job to do. These four groups furnish all or most of the following nutrients in the *Recommended Dietary Allowances:*

Calories
Protein
Calcium
Phosphorus
Iron
Magnesium
Zinc
Vitamin A
Vitamin D
Vitamin E
Ascorbic Acid
Thiamine
Riboflavin
Niacin
Vitamin B_6
Vitamin B_{12}
Folacin

We will cite the number, quantity, and kinds of food in each food group.

688. List three important nutrients found in milk, the daily recommended allowance for specified age groups, and the amounts of certain foods that can replace a given amount of milk.

Milk Group. Milk, cheese, and ice cream are the food choices in this group. Milk is a leading source of calcium, riboflavin, and high-quality protein, and it also provides



FOOD FOR FITNESS
Daily Food Guide

Some milk for everyone **MILK GROUP**

Children under 9 ... 2 to 3 cups
Children 9 to 12 ... 3 or more cups
Teenagers .... 4 or more cups
Adults.............. 2 or more cups

MEAT GROUP
2 or more servings

Beef, veal, pork, lamb
poultry, fish, eggs

As alternates --
dry beans, dry peas, nuts

VEGETABLE
FRUIT GROUP
4 or more servings

Include --

A citrus fruit or other fruit or vegetable important for vitamin C
A dark-green or deep-yellow vegtable for vitamin A — at least every other day
Other vegetables and fruits, including potatoes

BREAD
CEREAL GROUP
4 or more servings

Whole grain, enriched, or restored

PLUS OTHER FOODS AS NEEDED TO COMPLETE MEALS AND TO PROVIDE ADDITIONAL FOOD ENERGY AND OTHER FOOD VALUES

Figure 3-11. *Daily Food Guide.*

many other vitamins and minerals. Cheese and ice cream supply the same nutrients, but in smaller quantities. Daily quantities of milk recommended included:

1 pint for persons over 20 years old
1 quart (or more) for persons under 20 years

Any form of milk counts toward this total; for example:

Whole milk (any processed form)
Nonfat dry milk (reconstituted)
Buttermilk
Evaporated milk (reconstituted)

Cheese and ice cream can replace part of the milk. The amount of either needed to replace a given amount of milk is figured on the basis of its calcium content. Common portions of various kinds of cheese and ice cream and their milk equivalents in calcium are:

1-inch cube cheddar-type cheese = 1/2 cup milk
1/2 cup cottage cheese = 1/3 cup milk
2 tablespoons cream cheese = 1 tablespoon milk
1/2 cup ice cream = 1/4 cup milk

The importance of milk in the normal diet cannot be overemphasized. If milk or its equivalent is lacking in the diet, calcium and sometimes riboflavin are likely to fall below the amounts recommended for good health.

Exercises (688):

1. Milk is a leading source for what three important nutrients?

2. What is the daily recommendation of milk for persons under 20 years old?

3. How much cottage cheese is equal to 1/3 cup of milk?

689. Cite the place of meat in the diet in terms of the size of the recommended serving and the number of servings, and list some of the substitutes for meat.

Meat Group. A balanced diet should contain two or more servings daily of foods in the meat group. These important foods supply protein, niacin, iron, thiamine, fat, riboflavin, and other minerals and vitamins.

Recommended serving sizes are:

2 to 3 oz (60 to 90 gm) beef, boneless
2 to 3 oz (60 to 90 gm) veal, boneless
2 to 3 oz (60 to 90 gm) lamb, boneless
2 to 3 oz (60 to 90 gm) fish, shellfish, boneless
2 to 3 oz (60 to 90 gm) variety meats (liver, heart, kidney)
2 to 3 oz (60 to 90 gm) poultry, boneless
2 eggs

Alternates—1 cup of dry beans, dry peas, lentils, nuts, and peanuts, and 4 tablespoons of peanut butter.

About half of a day's protein requirement for the average adult is furnished by two servings from the meat group. Milk, cheese, bread, and cereals can supply the rest; dry beans, dry peas, and nuts also furnish vegetable proteins. Two servings from the meat group contribute almost one-half of the iron needed daily by an adult.

Exercises (689):

1. What is the recommended serving size of meats?

2. List the foods that can be used as alternates for meat.

3. How many servings of meat can supply an average adult with half of a day's protein requirement?

690. Specify how many servings of foods in the vegetable-fruit group should be included in the daily diet, and given a list of foods, indicate whether each is a good or fair source of ascorbic acid.

Vegetable-Fruit Group. The value of vegetables and fruits in the diet is far-reaching. They are rich sources of vitamins and minerals, they add interest to meals, and they provide fiber to the diet.

Four or more servings from the vegetable-fruit group should be included in the daily diet, placing special emphasis on sources of ascorbic acid and vitamin A.

The diet should include one daily serving of a "good" source or two servings of a "fair" source of ascorbic acid:

Good Sources	*Fair Sources*
Grapefruit or grapefruit juice	Honeydew melon
Orange or orange juice	Lemon
Cantaloupe	Watermelon
Raw strawberries	Asparagus tips
Broccoli	Raw cabbage
Brussel sprouts	Collards
Green pepper	Mustard greens
Sweet red pepper	Potatoes (cooked in skin)
	Sweet potatoes (cooked in skin)
	Spinach
	Tomatoes or tomato juice

Every other day, the diet should include at least one serving of a good source of vitamin A, such as:

Dark-green vegetables (broccoli, chard, kale, spinach)
Deep-yellow vegetables (carrots, sweet potatoes, winter squash)
Apricots
Cantaloupe

The recommended serving size of raw fruits and vegetables is the size ordinarily eaten—1 medium banana, half of a grapefruit, etc. The size of a serving of a cooked vegetable or fruit should be 1/2 cup (4 oz).

The fruits and vegetables suggested in the Daily Food Guide Plan will furnish all of the ascorbic acid needed and over half of the adult's requirement for vitamin A. The rest of the day's need for these nutrients is met by milk and dairy products, eggs, and the occasional use of liver. As we stated earlier in this chapter, true vitamin A is not found in fruits and vegetables. These foods, however, contain carotene, which the body converts to vitamin A.

Exercises (690):

1. How many servings from the vegetable-fruit group should be included in the daily diet?

2. In exercises (1) through (5), specify whether the food listed is a good (G) source, or a fair (F) source of ascorbic acid by placing a G or F in the space provided.

___ (1) Grapefruit.
___ (2) Collards.
___ (3) Cantaloupe.
___ (4) Green pepper.

691. Name two types of grains from the bread-cereal group, and specify why bread-cereal products are important.

Bread-Cereals Group. Foods in this group include whole grains, or processed grains that have been enriched or restored to their original nutritive value in iron, thiamine, riboflavin, and niacin. Foods in this class include the following:

Bread
Crackers
Flour (any baked products such as biscuits, cake, cookies)
Pasta—macaroni, noodles, spaghetti
Cooked cereals, such as rolled oats
Ready-to-eat cereals
Grits
Rice
Cornmeal

The Daily Food Guide Plan permits flexibility in the choice of foods from the bread-cereal group. For example:

3 slices of bread, plus 1 serving of cereal (1 oz. ready-to-eat or 1/2 cup cooked cereal) or
4 slices of bread, no cereal

This group furnishes worthwhile quantities of protein, especially when it is eaten with other high-quality protein from milk, meat, fish, poultry, or eggs. This group also supplies iron and other vitamins of the B-complex group. Bread-cereal products are very rich in carbohydrate; for this reason, they are an important source of food energy.

Exercises (691):

1. What types of grains are included in the bread-cereal group?

2. Since bread-cereal products are very rich in carbohydrates, they are important as what?

692. Specify the dietary value of miscellaneous foods.

Other Foods. The basic four food groups—milk, meats, fruits-vegetables, and bread-cereals—do not include the "extras" that go along with meals. The butter on bread, the dressings on salads, the sugar in coffee, and other such additional foods are part of most normal diets and contribute to the total value of the meal. The major nutritional contribution of these additional foods is calories. In addition to their calorie contribution, these "other" foods help make meals more satisfying and enjoyable. The most obvious way to add extra calories to a diet is to to serve extra portions of one or more foods recommended in the Daily Food Guide Plan.

The final point is to make sure that there is bulk (fiber) and water in the foods chosen from the four food groups. Both bulk and fluids are important. Fruits, vegetables, and whole-grain products will supply adequate bulk if these foods are included in the suggested amounts.

Milk, fruit juices, coffee or tea, and any other beverages provide part of a day's required fluid—1,440 to 1,920 ml (6 to 8 cups). Water (present in food and in additional drinking water) also counts toward the total recommended fluid intake.

Exercises (692):

1. The major nutritional value of additional foods is in ______ .

2. Fruits, vegetables, and whole-grain products will supply adequate _______ if these foods are included in the suggested amounts.

Emergency Procedures

THE DENTAL treatment room (DTR) is not usually thought of as a place where emergency conditions may arise. However, unforeseen problems do arise and accidents do occur. Regardless of how serene and tranquil the environment of a DTR may seem, an emergency situation may arise.

Many factors have contributed to dental emergencies. Ultraspeed rotary instruments have often injured the patient or dentist or the dental assistant. Elderly patients are often more susceptible to stressful situations than younger patients. Common drug therapy, which by design is meant to be helpful, is capable of producing hidden side effects that may result in reactions of a serious nature when the patients are subjected to routine dental procedures. It is the purpose of this chapter to clearly define the role of the dental assistant in such problem situations.

4-1. General Considerations

The concept of first aid in the DTR is not a new subject by any means, and there is often a narrow border line where first aid ends and bona fide medical treatment begins. Due to increasing claims of negligence in emergency situations and the moral obligation of the dental team to be prepared to manage their patients in the best possible manner, it is mandatory that dental personnel be knowledgeable of the prevention, differential assessment, and proper treatment of emergency states.

693. Given a series of key statements about first aid procedures, specify which statements about first aid are true and which are false.

First Aid Procedures. First aid is the emergency care administered to an injured or sick individual, which is intended to be a helpful or preventive measure, until the services of the dentist or a physician can be obtained. Every dental assistant should know the principles of first aid and must be prepared to offer competent assistance. Although each episode presents its own unique problems, there are some general considerations which apply to practically all situations. Understand the following rules before trying to master more specific first aid or emergency treatment.

a. Seek the aid of a dentist or a physician as soon as possible.

b. Remain as quiet and calm as you can during an emergency. Carry out your first aid procedures quickly, but do not rush around in a frantic manner.

c. Do not waste valuable time looking for first aid materials and items that are not readily available; do the best you can with what is available.

d. Keep the patient lying in a comfortable position, the head level with the body, until the seriousness of the condition is determined.

e. Appraisal of signs and symptoms of asphyxiation (impaired breathing), hemorrhage (serious bleeding), shock, and circulatory disorders are most important, since these conditions may require supportive breathing from a mechanical source or other prompt actions to maintain life.

f. Loosen tight clothing about the patient's neck, waist, and legs.

g. Never administer liquids by mouth to an unconscious patient since the swallowing mechanism is not efficient. It is of the utmost importance to maintain a patient's airway and at the same time prevent aspiration of liquids.

h. Treat injuries in order of their importance; first, asphyxiation; second, hemorrhage; third, shock.

i. Do not touch an open wound with bare hands unless the emergency requires you to do so.

j. Try to maintain the body temperature of the patient within relatively normal limits.

k. Do not attempt to move an emergency patient unless it is absolutely necessary.

l. Do your utmost to keep the patient as comfortable as possible, to minimize pain, and to reduce anxiety.

m. Most important of all, realize that it is best to defer any definitive treatment until you are sure of the primary problems.

In general, it is not wise to perform or administer treatment that is beyond your knowledge and training. Subsequently in this chapter you will find information which may enable you to go somewhat beyond the ordinary limits of first aid treatment.

Exercises (693):

Mark the following statements regarding first aid procedures as true or false and explain any false answers.

T F 1. Seek the aid of the dentist or a physician only when you have the emergency under complete control.

T F 2. Do not waste valuable time looking for first aid materials and items that are not readily available.

T F 3. Keep the patient lying down in a comfortable position, the head level with the body, until the seriousness of the condition is determined.

T F 4. Administer liquids by mouth to an unconscious patient to prevent dehydration.

T F 5. Treat injuries in the following order of importance: first, shock; second, hemorrhage; third, asphyxiation.

T F 6. Do not attempt to move an emergency patient unless it is absolutely necessary.

694. Specify the contents of emergency kit items and state the use of emergency treatment kits.

Emergency Treatment Kit. All dental clinics should set up an emergency treatment kit, tray, or drawer convenient to every location where patients are treated. If you use a cabinet drawer, use the same drawer in all dental cabinets to avoid confusion. You should be completely familiar with all the drugs and equipment in this drawer so that you can properly assist in any emergency and can maintain the equipment and supply levels. The following is a list of drugs and materials to include in the dental emergency kit:

a. Airway for mouth-to-mouth resuscitation.
b. Ammonia capsules—a mild stimulant for syncope.
c. Epinephrine 1:1,000—antiallergic drug.
d. Diphenhydramine (benadryl)—antiallergic drug.
e. Pentobarbital or sodium secobarbital—sedative and anticonvulsive.
f. Amyl nitrate pearls and nitroglycerin tablets—coronary dilators for angina pectoris.
g. Ephedrine sulfate, injectable—vasopressor.
h. Solu-Cortef—severe shock and acute reactions to drugs.
i. Small package of sugar—for diabetic hypoglycemia.
j. Materials for administering these drugs—syringes, hypodermic needles, sterile isotonic saline, 5 percent dextrose solution, and a tourniquet.

The contents of emergency kits may vary slightly from clinic to clinic, depending upon doctor preferences and the services the clinic provides. Your role in using an emergency kit is supportive. Mainly, your duties are to maintain the emergency kit and to assist the dentist as he or she uses the kit. In either case, apply yourself as if human life depends directly upon you.

The proper maintenance of an emergency kit is a daily affair. You should inspect the kit daily and correct any deficiencies noted. Inspections have revealed that some kits contain drugs with expired potency dates and that previously used drugs are not always replaced. Be sure to keep your kit(s) complete and ready for use.

Your assistance in the proper use of the emergency kits increases the dentist's total treatment capability. When you perform your tasks, you free the dentist to concentrate more upon his or her professional activities. Normally, your tasks include placing needles and syringes, loading syringes with proper drugs and applying tourniquets for intravenous injections.

Exercises (694):

1. Match the purpose listed in column B to the item listed in column A.

Column A

____ (1) Ephedrine sulfate.
____ (2) Solu-Cortef.
____ (3) Pentobarbital.
____ (4) Syringes, needles, and tourniquet.
____ (5) Benadryl.
____ (6) Ammonia carpules.
____ (7) Airway.
____ (8) Nitroglycerin tablets.

Column B

a. A mild stimulant for syncope.
b. An antiallergic drug.
c. For mouth-to-mouth resuscitation.
d. Materials for administering drugs.
e. A coronary dilator for angina pectoris.
f. To act as a vasopressor.
g. A sedative and anticonvulsive.
h. For severe shock and acute reactions to drugs.

695. Specify the use of oxygen-inhalation equipment.

Oxygen-Inhalation Equipment. An apparatus for dispensing oxygen is a major piece of equipment in any dental clinic. Small, portable units with two tanks should be stored conveniently near the DTR. In some larger and newer clinics, oxygen is installed in the walls of each DTR. With this arrangement, adjustable dispensing units are immediately available to provide oxygen for the ailing patient. Sterile masks in adult and child sizes should be stored in each DTR so that a clean mask may be placed quickly on the oxygen unit when needed.

Inhalation equipment (fig. 4-1) is most useful for many emergencies that may occur in the dental clinic. Proper utilization of the equipment will allow the administration of supplemental oxygen with positive pressure. The following steps are recommended:

a. The mask should be filled and held tightly over the patient's mouth and nose with one hand.

b. The flowmeter is adjusted to deliver a flow of 5 to 10 liters of oxygen per minute to the patient's lungs.

c. The movement of the patient's chest is observed as an indicator of a patient's airway. Also, the color of the skin and pulse rate are noted.

d. If necessary, increased chest movement may be accomplished by applying intermittent pressure to the

Figure 4-1. Inhalation equipment.

rubber bag at the rate of 18 to 20 respirations per minute until normal breathing is restored.

Exercises (695):

1. What is oxygen-inhalation equipment?

2. Where should sterile oxygen masks be stored?

3. What will proper utilization of inhalation allow?

4. How should the flowmeter be adjusted?

4-2. Patient's Vital Signs

Prior to rendering treatment to a patient, information should be sought relative to his or her general health status. An important element is an adequate medical history of the patient on AF Form 696, Dental Patient Medical History. You should check with the patient before initiating any treatment to insure that their health history is current. Another critical factor of an examination in routine care or emergency first aid is checking the vital signs of a patient. Checking vital signs includes taking a patient's pulse, blood pressure, respiration rate and temperature. This should be a routine procedure as you prepare the patient for dental treatment.

696. State the procedures for obtaining a patient's vital signs.

Pulse. The pulse is created by the forceful pumping of blood by the heart muscle from the heart chambers into the aorta (largest artery) and other major arteries. The pulse is most readily detected near the surface of the skin; the normal pulse rate in adults is between 60 and 80 heartbeats per minute. In children, the rate is faster—from 80 to 100 beats per minute. To take the pulse rate, have a wristwatch or some other watch that has a second indicator. You should record the pulse rate right away.

Pulse in wrist (radial artery). The radial artery on the inner surface of the wrist (thumb side) is the most commonly used site for taking the pulse. The index and third fingers of the hand are placed lightly on the area between the tendons, and the heartbeat is counted for 30 seconds and doubled or taken for a full minute.

Pulse in neck (carotid artery). The heartbeat pulsing the blood into the carotid artery will be detected by placing the fingertips of the right hand into the soft tissue of the neck immediately above the clavicle on a perpendicular line below the angle of the mandible and to the side of the trachea. The normal count is the same as for the pulse in the wrist—60 to 80 beats per minute.

Respiration Rate. The normal adult respiration rate for a relaxed person should be 17 breaths per minute. The breathing should be deep and regular. If the patient is in a state of shock, the breathing rate will be rapid, shallow, and labored, particularly if there is an obstruction of the airway or if the patient has heart disease. If the patient is in respiratory failure or arrest, there will be little or no movement of the chest or abdomen.

Temperature. Usually the patient's temperature is taken with a thermometer placed in the mouth and positioned under the tongue. The sterile thermometer is held by the tip, opposite the low gradations. Shake it gently until the mercury is forced down into the small tip (fig. 4-2). The

Figure 4-1. Inhalaton equipment (Cont'd).

Figure 4-2. Thermometer.

thermometer is then placed under the patient's tongue and is left in place for approximately 2 minutes. The patient is instructed to close his or her lips gently on the thermometer and to refrain from talking, which could possibly move it out of the mouth.

After the required interval, the thermometer is removed from the patient's mouth and held parallel to the floor until the end of the mercury level can be seen. The number on the graduated scale corresponding with the extent of the rise of mercury within the glass tube will indicate the temperature. (Refer again to fig. 4-2.)

The thermometer must be read immediately, because when it cools the reading will not be accurate. The reading should recorded. The normal reading for most patients is 98.6° F. Some individuals routinely have a lower or higher "normal" temperature. If this is determined, it should be noted on the patient's AF Form 696. The thermometer should be cleansed with an approved agent (70 percent isopropyl alcohol, etc.) and placed in a sterile container for future use.

Blood Pressure. Blood pressure is recorded at the initial examination and should be included on completed AF Form 696. All assistants must be capable of accurately taking and recording blood pressure. Recording the blood pressure should precede the administration of any type of medication.

The two types of blood pressure recorded are *systolic* and *diastolic*. *Systolic* pressure is the highest pressure exerted on the circulatory system by the contraction of the left ventricle of the heart. This contraction forces the blood out into the circulatory system.

The lowest pressure of the circulatory system occurs momentarily when the heart muscle rests and takes in more blood prior to the next contraction. This pressure is called the *diastolic*.

The normal range of blood pressure for the adult male is systolic pressure 110 to 120 millimeters (mm) mercury (Hg), diastolic pressure 65 to 80 mm Hg. In the normal female, the blood pressure range is systolic pressure 105 to 110 mm Hg, diastolic pressure 60 to 75 mm Hg. The difference between the systolic and the diastolic pressures is the pulse pressure, which indicates the volume of blood the heart forces into the aorta during each contraction.

Equipment needed for taking and recording the blood pressure.

- Stethoscope.
- Sphygmomanometer (blood pressure cuff) with gauge.
- Patients AF Form 696, Dental Patient Medical History.
- Ink pen (black or blue-black); all entries on AF Form 696 are made in ink.

Placement of blood pressure apparatus. The patient should be lying (supine position) or sitting in the dental chair.

(1) Have the patient rest quietly for a few minutes before recording the blood pressure.

(2) Extend patient's arm (left or right); support the elbow on the arm of the chair or table. The palm should be facing upward.

(3) Place the blood pressure cuff with the "bladder" on the inner arm area of the upper arm near the brachial artery (fig. 4-3). If the arm is injured, the cuff should be placed on the artery in the leg.

(4) Use one hand to stabilize the end of the cuff. With the other hand, wrap the cuff comfortably around the upper arm. (NOTE: Place the cuff so that the gauge of the sphygmomanometer faces you. If the gauge is portable, place it on an adjacent table where you can read it.)

(5) Expel all air from the cuff by opening the bulb on the end of the tubing and pressure cuff.

(6) Place the earpiece of the stethoscope in the ears. The disc (diaphragm) of the stethoscope is placed over the brachial artery at the inner area of the elbow on the upper arm.

Procedure in obtaining blood pressure reading.

(1) Check the closure of the valve on the inflation bulb with the right hand. The bulb can be held in the palm of the hand, and the fingers are used to rotate the valve opening (adjustment).

(2) Feel the pulse of the patient by placing the fingertips of the left hand on the radial artery near the thumb side of the inner wrist.

(3) Check the location of the brachial artery immediately near the tendon at the elbow. Place the stethoscope disc over the area of the brachial artery at the medial side of the tendon.

(4) Listen for the sound of the pulse. Pump the bulb on the cuff until the sound of the pressure can no longer be heard.

(5) Check the reading of mercury (Hg) on the gauge of the blood pressure apparatus. Reading may be up to 160 to 180 mm of Hg.

(6) Release the valve tip of the bulb slowly. Notice the drop of Hg in the gauge.

(7) While listening with the stethoscope, inflate the cuff by pumping the bulb. The reading on the mercury gauge should be 10 to 20 points above the reading acquired when testing the apparatus (170–190).

(8) Slowly open the bulb and release the pressure on the cuff as you listen with the stethoscope (the mercury pressure in the gauge will drop approximately 2 mm with each heartbeat).

(9) Note the registration of a *sharp, tapping sound* as you lower the air pressure in the cuff. This is the *systolic pressure*, the sound of the pressure in the arteries as the heart is contracting, pushing the blood into the arteries and out of the heart.

(10) *Slowly* continue to release the air in the cuff, deflating the apparatus. Deflate until the *last* sound on the

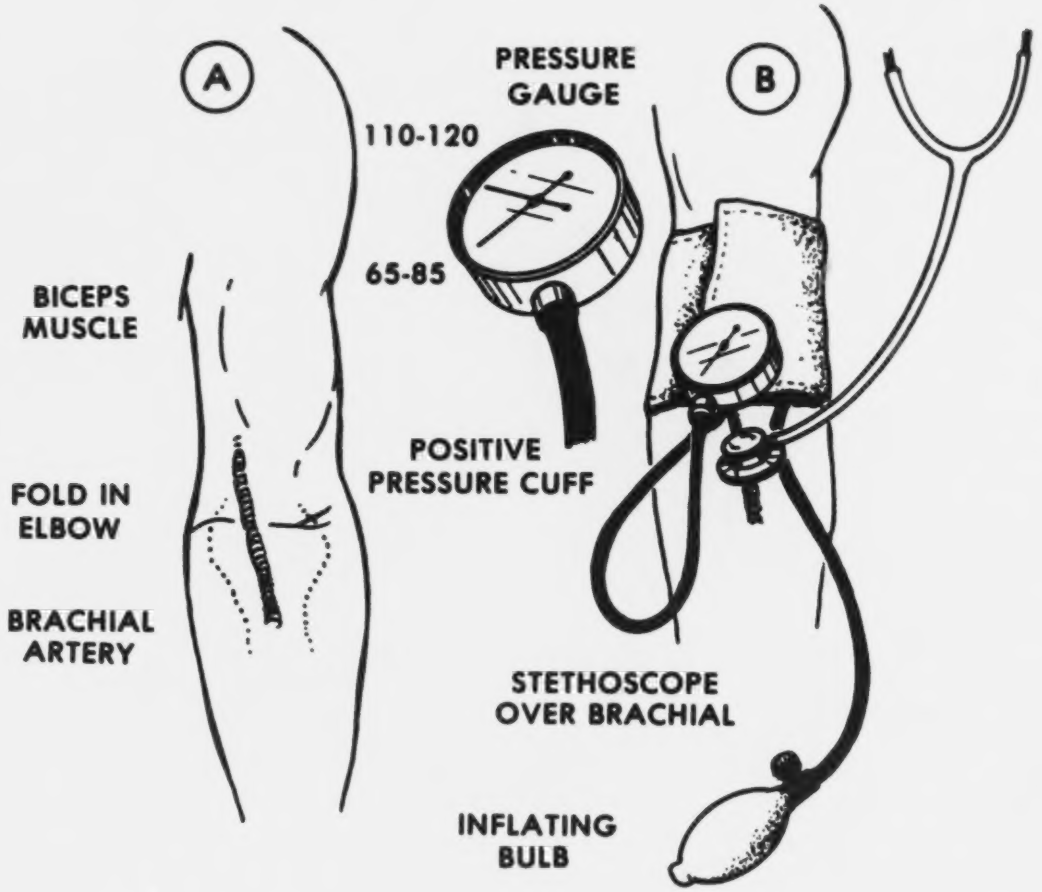

A
PRESSURE GAUGE
B
110-120
65-85
BICEPS MUSCLE
POSITIVE PRESSURE CUFF
FOLD IN ELBOW
BRACHIAL ARTERY
STETHOSCOPE OVER BRACHIAL
INFLATING BULB

Figure 4–3. Blood pressure cuff placement.

heartbeat is heard. This is the registration of the *diastolic pressure*, the sound as the heart relaxes and prepares itself to receive more blood.

(11) An *example* blood pressure reading would be recorded in this manner.

$\frac{132}{74}$ (blood pressure)

132 mm Hg = systolic pressure
74 mm Hg = diastolic pressure

NOTE: The blood pressure reading may be taken two or three times to obtain an accurate or average reading if the patient appears to be apprehensive at the time for the first reading. The blood pressure cuff can remain on the arm in a loosened position after the first reading is obtained.

Exercises (696):

1. Where is the pulse most readily detected?
2. What is the normal pulse rate for an adult? A child?
3. What is the respiration rate like for a person in a state of shock?
4. If a patient routinely has a lower or a higher than normal temperature, what should you do?
5. What is systolic pressure?
6. What is diastolic pressure?

7. The difference between the systolic and the diastolic pressure indicates what?

8. Where is the disc (diaphragm) of the stethoscope placed when taking a patient's blood pressure?

4-3. Medical Emergencies

If emergencies occur, you must be able to recognize them and assist in correcting them. There are many types of medical emergencies that can arise in the dental clinic. We will cover the more common ones. Any medical emergency is important and should always be given your undivided attention. The following brief descriptions provide only word pictures of emergency conditions and procedures. There should be regular training sessions in your section to make sure that all personnel are qualified to administer appropriate life-saving measures.

697. Identify the different types of shock and the treatment procedures for shock.

Shock. In medicine, shock means the state of collapse of the cardiovascular system. Stimuli that cause the opening and closing of the blood vessels of the vascular system include fright, heat and cold, and the needs of the body organs for oxygen and the removal of waste. The control of the involuntary nervous system is entirely automatic.

Shock, then, is a condition that alters the normal flow of blood through the vascular system and is caused by:

(1) Damage to the heart, the organ responsible for the circulation of the blood;

(2) Sudden loss of a quantity of blood through hemorrhaging.

(3) Dilation of the vessels of certain regions of the body, which prevents the normal flow of blood throughout the circulatory system.

Types of shock. Types of shock include hemorrage, respiratory (insufficient breathing), neurogenic (loss of control of the nervous system), psychogenic (fainting), cardiogenic (inadequate function of the heart), septic infection, anaphylactic (allergic reation), and metabolic. The types of shock most common to patients in the practice of dentistry will be covered in the following text.

Psychogenic shock. In this type of shock, the nervous system, reacting to a stimulus of fright or fear, causes a temporary reduction of the blood supply to the brain. Frequently the patient may be frightened of anticipated dental treatment or he or she may be overly tired from work and lack of sufficient rest. Prolonged waiting for treatment in a reception area or in an operatory is not conducive to the relaxation of a patient.

In psychogenic shock, the flow of blood to the brain has been temporarily interrupted. The patient may complain of the room being too warm, appear agitated, and attempt to loosen his or her clothing.

Syncope. The assistant must be alert to the symptoms of pallor and clamminess that accompany the condition of fainting (syncope, a temporary suspension of consciousness caused by cerebral anemia). Frequently, the lowering of the patient in the dental chair to a *supine* position is sufficient to revive them. The patient's feet should be elevated to a position higher than his or her head to cause the blood to flow away from the stomach and toward the brain.

A glass ampule of spirits of ammonia may be fractured in a gauze square and wafted gently under the patient's nostrils to cause him or her to inhale quickly and thus receive oxygen.

Spirits of ammonia should not be held directly under the nostrils, as the aromatic substance of the ammonia vapors may cause irritation to the membrane of the nostrils and the nasal cavity.

The pulse rate and blood pressure should be taken and registered for the dentist to interpret. Usually the patient will regain consciousness within one or two minutes.

Anaphylactic shock. Anaphylactic shock is a severe, allergic response of the patient's body to a foreign protein substance in the blood. Allergic responses in an individual may be stimulated by sensitivity to certain foods, the administration of a medication or the sting or bite of an insect.

The exact cause is not fully understood, but medical specialists contend that the foreign protein elicits a response of a sudden release of histamine in the blood stream, which in turn allows plasma to flow through the capillary walls into the tissue.

This action causes a decrease in the amount of blood returning to the heart, which in turn causes the circulatory needs of the body to suffer, and shock follows *immediately*. Immediate treatment is *imperative*.

Symptoms that may accompany allergic reactions to medications are extreme edema (swelling) of the tissues of the body, a rash (urticaria) or large welts (wheals). Swelling of the tissue of the larynx and the bronchi will cause obstruction of the airway, the trachea. The patient may show sings of choking, nausea, coughing, and cyanosis (blue pallor) and may lose consciousness if relief is not immediate.

Treatment for shock. Treatment for anaphylactic shock is similar to that for syncope (fainting). In addition, a specific allergic agent (a drug) is administered. The assistant *must* know all the medications in the emergency kit.

Epinephrine, 1:1000, in a dosage of 0.5 ml, may be administered subcutaneously in the arm or thigh. The dental assistant will prepare the sterile syringe at the request of the dentist. If the reaction is severe, an additional dose may be administered in another 10 minutes.

Oxygen (O_2) will relieve the patient's distress and should be administered along with the antiallergic drug. Remember—oxygen is effective only if the patient is breathing. Antihistamines and corticosteriods are usually prescribed as followup treatment.

Exercises (697):

1. Match column A with the correct description listed in column B.

Column A

____ (1) Psychogenic.
____ (2) Syncope.
____ (3) Anaphylatic.
____ (4) Cardiogenic.
____ (5) Respiratory.
____ (6) Neurogenic.

Column B

a. Allergic reaction.
b. Inadequate function of the heart.
c. Fainting.
d. A temporary suspension of consciousness caused by cerebral anemia.
e. Loss of control of the nervous system.
f. Insufficient breathing.

2. When treating anaphylatic shock, what drug is prepared and in what amount?

3. What will oxygen do for a patient suffering from shock?

698. Define pulmonary and cardiac arrest and identify cardiopulmonary emergency procedures.

Pulmonary Arrest. The patient in pulmonary arrest is not moving sufficient air into and out of his or her lungs.

Mouth-to-mouth resuscitation will provide ventilation to the patient, while, at the same time, you can watch the results on inflation of the chest. As you turn your face toward the patient's chest, you supply artificial respiration (see figure 4-4).

Steps of artificial ventilation. Artificial ventilation (artificial respiration) means that breathing is maintained by one person by artificial means for another person.

(1) Restore the airway; place the patient in a supine position (face up).

a. Extend (straighten) the neck; tilt the head backward.

b. Draw the chin downward.

c. Retrieve any foreign material in the mouth or throat with the fingers.

d. Remove any prosthesis the patient may be wearing, if it is likely to drop free of the dental arch.

(2) Start artificial ventilation.

a. Mouth-to-mouth.

b. Mouth-to-nose.

c. Use of an S-shaped plastic tube inserted at the back of the tongue into the pharynx.

Mouth-to-mouth technique. (refer again to fig. 4-4.)

(1) The head and chin position of the patient must be checked. Place one hand under the neck of the patient. The head is tilted back with the chin of the patient dropped down to open the mouth and the airway.

(2) Kneel at the patient's side (either side) close to his or her head. If the patient is in the dental chair, lower the position of the chair to enable the operator to use the operator's stool.

(3) Pinch the patient's nose, using the hand placed on the forehead to support the position of his or her tilted head.

(4) Take a deep breath.

(5) Make a tight seal by placing your mouth completely around the patient's mouth.

(6) Blow air into the mouth until the chest expands (watch patient's chest for rise).

(7) Remove your mouth from the patient's mouth to allow air in the lungs to be expelled. Move your head away as you take another breath. If the patient's chest rises rapidly, stop inflation, raise mouth and permit the patient to exhale. Repeat cycle 15 times per minute.

(8) Chest rising is more important than rhythm.

If the victim is a child, the force of air should be lessened. Your mouth can be placed over the nose and mouth of the child patient. If the position of the patient's mandible is difficult to maintain, use the hand that is supporting the neck to move the mandible downward.

Mouth-to-nose method. If the patient's mouth is severely injured or the teeth are missing, the mouth-to-nose method may be applied.

(1) Close the mouth with one hand, holding the lips sealed.

(2) Take a deep breath and seal the lips over the patient's nose.

(3) Blow air into the nose until the patient's chest rises.

(4) Remove your mouth. Turn your face and open the patient's mouth to permit the patient to exhale the air.

Artificial airway devices. Devices have been designed to fit the curvature of the oropharynx. These devices are designed in sizes for adults and children. Further, these devices are used when a patient is unconscious; otherwise, the extension of the device in the posterior of the throat, behind the base of the tongue, may cause a gag reflex.

Cardiac Arrest *Death* occurs when the heart stops pumping blood. It can occur at any time, at any age. In some people it may occur because of a reaction to medication or a sudden heart attack.

In cardiac arrest the heart has stopped beating and the patient has stopped breathing. Oxygen is not being taken into the tissues. Some body cells can live for a time on a limited supply of oxygen. The *brain* cells, the most sensitive tissue in the body, will be *irreversibly* damaged after 4 to 6 minutes without oxygen.

If the heart can be forced to beat and the patient forced to breathe, the blood can be forced to circulate, and the brain and other tissues will receive their necessary supply of oxygenated blood.

General types of cardiac arrest.

(1) Ventricular standstill, asystole (no heartbeat).

(2) Ventricular fibrillation (erratic heartbeat).

(3) Cardiovascular collapse (no pulse, no blood pressure).

Diagnostic signs of cardiac arrest.

(1) No perceptible breathing.

(2) No pulse in wrist, carotid artery of the neck, or femoral artery in the groin.

(3) No heartbeat.

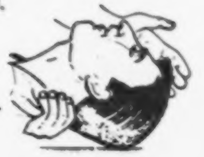
(4) Dilated pupils. These signs occur in cardiac arrest when the brain is without oxygenated blood, as the tissue cells cannot function. The patient's symptoms are loss of

DENTAL CARDIOPULMONARY EMERGENCY PROCEDURES

ALL EMERGENCIES

Place patient horizontal - send for help if required.

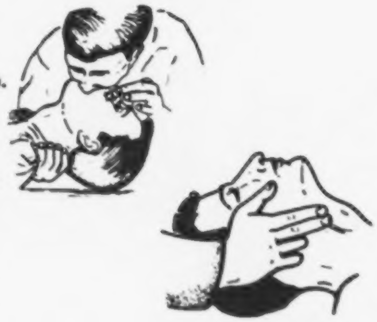
IF UNCONSCIOUS



AIRWAY- Open air passage by tilting head back.
Check breathing and pulse.

IF BREATHING

Administer oxygen.
Suction airway, if indicated.
Give aromatic spirit of ammonia by inhalation.



IF NOT BREATHING

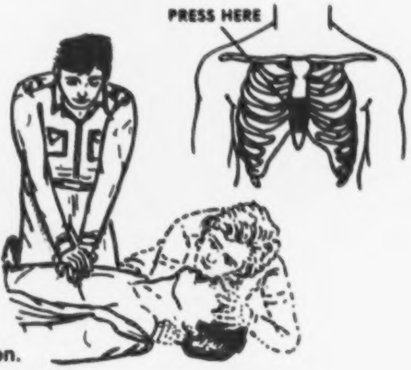
BREATHE —Inflate lungs quickly 3 to 5 times:

- Mouth-to-mouth
- Mouth-to-nose
- Mouth-to-airway
- Mechanical means

IF CAROTID PULSE IS PRESENT

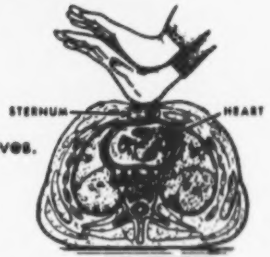
Continue 12 lung inflations per minute.
If pulse is weak & threadlike, administer
1cc of 1:500 phenylephrine I. V.

IF CAROTID PULSE IS ABSENT OR PUPILS DILATED & DEATHLIKE APPEARANCE



CIRCULATE—Compress lower sternum 1½ to 2 inches.
Rate of once per second.
One operator: Alternate 2 quick inflations with 15 chest compressions.
Two operators: Interpose 1 lung inflation after every 5th chest compression without any pause in chest compression.
Continue resuscitation until spontaneous pulse returns.

AFTER 5-10 MINUTES OF CARDIOPULMONARY RESUSCITATION



DRUGS— Inject 1cc of 1:1000 epinephrine I. V.
Continue resuscitation at least one hour or until help arrives.
Have other drugs on hand for use of physician:
- Sodium bicarbonate (3.75 Gm/50cc)
- Cardiotonic
- Corticosteroid

Rapid, weak pulse - inject 1-2 cc 1:500 phenylephrine I. V.
Irregular pulse - administer oxygen only.

Figure 4-4. Artificial respiration procedures.

consciousness; no stimulus from the brain to effect breathing; and cessation of the nervous impulses to the muscles that control the pupils of the eyes. The pupils will dilate 30 to 40 seconds following an adverse effect on circulation of the blood to the brain. Complete dilation of the pupils will occur in 1 minute.

Essential ABC's in cardiopulmonary resuscitation (CPR).

(1) *Airway* opened and maintained. (Refer again to figure 4-4.)

(2) *Breathing* restored by artificial ventilation.

(3) *Circulation* restored by artificial circulation (external cardiac compression).

Procedure for cardiovascular pulmonary resuscitation. Emergency care and transportation of the patient are under the guidance of the dentist and a physician. Position the patient in a supine position on a hard surface, such as the floor.

(1) To prevent circulation of blood with a high content of carbon dioxide, ventilate the lungs by using mouth-to-mouth resuscitation three times. If you do the mouth-to-mouth resuscitation, you must do so immediately while the second person is getting into position with his or her hands on the sternum of the patient.

(2) When sudden cardiac arrest occurs, the *carotid pulse* should be checked immediately. With the patient lying in a supine position, you (or the other person) place yourself at the shoulder of the patient. The fingers of one hand are placed alongside the larynx (Adam's apple) and follow the groove laterally down to the soft area above the clavicle. The area is palpated gently to determine carotid pulse.

(3) To locate an area on the sternum for compression, move your fingers around the patient's rib cage from the opposite side of the chest from you to the center of the sternum. Place all fingers over the xiphoid (lower tip of sternum). To compress the heart, locate the lower part of the sternum (see fig. 4-4), approximately 1 1/2 to 2 inches *above* the tip of the sternum.

(4) Place the heel of the opposite hand on the lower half of the sternum by placing the hand *above* the width of fingers resting on the tip of the sternum. *DO NOT* place the heel of your hand on the xiphoid, the tip of the sternum; to do so could cause it to fracture and possibly puncture the lung tissue. The first hand is pointed up over the ribs. Only the heel of the hand rests on the sternum.

External cardiac compression must always be accompanied by ventilation—artificial respiration. External cardiac compression can produce systolic blood pressure peaks of over 100 mm Hg in the carotid arteries, although the diastolic pressure falls to zero and the mean blood pressure seldom exceeds 40 mm Hg. These low volumes of blood pressure, therefore, emphasize the need for uninterrupted cardiopulmonary resuscitation (CPR) and for speed in restoring an effective heartbeat for the victim.

To oxygenate the blood, artificial ventilation should be started *before* external cardiac compression is applied and continued at recommended intervals as long as external cardiac compression is applied.

Procedure for applying ventilation (artificial respiration). The patient's head is tilted upward and backward in an attempt to clean the airway. With this position of the head, the tongue drops down into the lower part of the floor of the mouth and does not obstruct the passage of air into the trachea. With the rescuer kneeling closely at the patient's side near the shoulders, he or she places one hand under the neck at the base of the patient's skull. The other hand is placed on the patient's forehead with the fingers pinching the nostrils closed.

The rescuer takes a deep breath and places his or her lips and mouth over the patient's mouth, blowing his or her breath firmly into the patient's mouth. (To be effective, the rescuer's lips must completely seal the patient's mouth.) The rescuer lifts his or her face slightly and turns his or her head toward the patient's chest to notice deflation of the chest. If you maintain a good seal as you exhale into the patient's mouth again, you should notice the rise of the patient's chest as the air enters the lungs.

The second rescuer is in a position at the other side, at the upper chest of the patient. This rescuer assumes the correct position to maintain a forward position of his or her upper body weight over the patient's chest. The hips of the second rescuer become a fulcrum for pivoting his or her upper body weight directly over the patient receiving external cardiac compressions.

Two rescuers. The external cardiac compressions accompanying ventilation (artificial respiration) are given at a ratio of 5:1 (five chest compressions to one lung inflation), maintaining 60 chest compressions per minute. The artificial respiration should be given on the upstroke of the rescuer administering external cardiac compressions, thus attempting to provide a smooth flow of blood and oxygen to the patient's brain without interrupting the rhythm of the compressions to inflations.

One rescuer. The external cardiac compressions to artificial respirations for one rescuer administering CPR is on a 15:2 cycle. Two very quick ventilations follow each 15 compressions. The chest compressions are delivered at a rate of 80 per minute. Therefore, the one-rescuer cycle is 15 chest compressions to two quick lung inflations, then 15 chest compressions, equaling 80 per minute.

Pupils of victim's eyes. When CPR is being administered to a patient, the pupils of the patient's eyes should be checked frequently. If the patient's pupils remain dilated when exposed to light, a sufficient amount of oxygenated blood is *not* reaching the brain. If the pupils constrict with light, less damage to the brain is anticipated.

The pupils of the eyes of older persons and persons of any age who have been administered drugs will contract at varying degrees, reacting more slowly to pupillary stimuli.

Administering CPR to a child patient. The rescuer should use restraint in administering external cardiac compressions to the small child or infant. Only the heel of one hand on the sternum is indicated for a chest compression of a small child (10 years old or less). Only the tips of the index and middle fingers are used to compress the sternum of the infant. The infant is held in the lap of the rescuer. (CAUTION: : Heavy compressions could cause injury to the liver or spleen.)

Artificial respiration and ventilation of lungs should be applied, using the same ratios to external cardiac compressions: 5:1 or 15:2, depending on the number of rescuers. A lighter volume of air is indicated for the small child and infant to avoid damage to the lungs; however, care must be taken that the correct pressure is applied in producing cardiac compressions. The following complications may occur as the result of the emergency treatment but may be a lesser price to pay for saving a life: broken ribs; broken sternum; pneumothorax (a broken rib puncturing the lung); laceration of the liver, spleen, lungs, or heart from broken ribs.

Exercises (698):

1. What is pulmonary arrest?
2. What is artificial ventilation?
3. Briefly explain how to restore a patient's airway.
4. List the three ways to start artificial ventilation.
5. When performing the mouth-to-mouth technique of artificial ventilation, what is more important than rhythm?
6. When would you use the mouth-to-nose method of artificial ventilation?
7. When are artificial airway devices used?
8. What is cardiac arrest?
9. List three types of cardiac arrest.
10. What are the diagnostic signs of cardiac arrest?
11. List the essential "ABCs" in cardiopulmonary resuscitation.
12. When sudden cardiac arrest occurs, what pulse should be checked immediately?
13. What must always accompany external cardiac compression?
14. What is the compression/ventilation for the two rescuers?
15. What is the compression/ventilation for one rescuer?
16. When the pupils of a victim's eyes remain dilated when exposed to light, what is happening?
17. What type of injuries may occur from heavy compressions during CPR?

699. Given descriptions of medical emergencies, identify each emergency and the action that should be taken.

Toxic Reactions. Toxic reactions usually result from an overdose (or excessive amount) of a drug. Toxic reactions take place because of a concentration of the drug in the patient's blood stream to impede his or her respiration or circulation. These reactions are caused by administering too much of the drug or administering it too fast. The dentist should diagnose and treat toxic reactions. The proper emergency treatment is to place the patient in the supine or Trendelenburg position (on his or her back on a plane inclined approximately 45° with legs and feet hanging over the end of the chair) and administer oxygen.

Anesthetic Allergy Reaction. There are three types of reaction to local anesthetics: allergic reaction, toxic reaction, and hypersensitivity.

a. Allergic reaction. The most common allergic reaction to local anesthetics is a rash, swelling, or redness. The rash appears on other parts of the body, such as the arms. The swelling and redness are usually found around the area of injection. These reactions usually occur soon after the injection, though swelling may occur at the injection site from 12 to 24 hours later. The anaphylactic (allergic) shock is the least common of the reactions from a local anesthetic. This reaction is characterized by a sudden circulatory or respiratory collapse. The blood pressure drops and respiration is impaired. The dentist usually treats this type of reaction with a subcutaneous injection of 1:1,000 epinephrine. Administer oxygen under pressure or by mouth-to-mouth resuscitation. An antihistamine drug may also be given. These reactions should be treated by the dental officer. In mild cases, oral antihistamines may be given. In the more severe cases, injections of epinephrine or antihistamine may be given.

b. Toxic reactions. Toxic reactions are the result of an overdose of local anesthetic. We discussed this type of reaction earlier. In dentistry, toxic reaction to a local anesthetic is usually the result of injecting the solution directly into a blood vessel. Oxygen should be administered.

c. Hypersensitivity. Some patients are hypersensitive to local anesthetics. These patients develop all of the symptoms of a toxic reaction, even when they receive only a minimal amount of the drug. The diagnoses and treatments are the same as for toxic reactions discussed earlier. Oxygen should be administered.

Penicillin Allergy Reaction. There are two types of reactions to penicillin. The first type is the immediate or anaphylactic type, which occurs within minutes to several hours after administration. The delayed or serum sickness type of reaction occurs several days to 2 weeks after administration. This type is characterized by urticaria, angioneurotic edema, fever, pain in the joints, and swelling.

Penicillin injections should not be given in the dental clinic. The dentist should prescribe oral penicillin if conditions permit. If this is not possible, injections should be given in the hospital emergency room.

Angioneurotic Edema. This is a form of giant urticaria (hives), characterized by localized painless swelling of subcutaneous tissue in various parts of the body. It may also appear in the mouth. The reaction is an allergic response to food, drugs, infections, or emotional stress. This reaction is common in patients with a history of allergy. It is also caused by trauma. It must be treated by the doctor with an antihistamine drug, such as benadryl.

Diabetes Mellitus. Diabetes mellitus is a disease in which the patient is unable to metabolize sugar normally. Diabetes may be controlled by a diet of low sugar intake (carbohydrates), by pills, or by daily injections of insulin. A physician regulates the individual's insulin need. The patient must follow the prescribed routine of diet and medication.

Severe conditions may occur in the patient's health, demanding emergency care, if the prescribed routine for diabetes is not followed. Two of the most common conditions are defined below.

Diabetic coma. Diabetic coma occurs when a patient receives insufficient amounts of insulin. The abundance of sugar in the blood is not utilized, and the body cells do not receive the nutrient. The body cells, needing sugar, use other energy sources, which drastically affect the well-being of the body. For example, waste products are slightly acid; these acids in the blood may cause diabetic coma.

In diabetic coma, symptoms occur because of the ingestion of too much sugar in the food. The patient may not have taken enough insulin or may have an infection.

In diabetic coma, the clinical signs are (1) an acetone breath (smelling like fruit); (2) warm, dry skin and dry mouth; (3) rapid but weak pulse; (4) air hunger, rapid, deep breathing; and (5) unresponsiveness to questioning.

If the patient is conscious, ask when he or she last ate and whether or not he or she has taken the prescribed insulin. If a diabetic coma is present, the patient has probably eaten but has *not* taken the prescribed insulin. When a case of diabetic coma occurs (hyperglycemia—too much blood sugar) the patient needs insulin and other medication.

Insulin shock. Insulin shock is caused when too much insulin and too little food are taken into the body. The blood is rich in insulin. The sugar supply to the brain tissue drops and unconsciousness follows.

If insulin shock is present, the patient has probably taken insulin but has *not* eaten. For insulin shock administer sugar, candy, orange juice, ginger ale, or other sugar-containing foods and call a physician immediately. (NOTE: If the patient has lost consciousness and you are not sure whether the patient is suffering from diabetic coma or insulin shock, try to place a sugar cube under the patient's tongue. If the condition is insulin shock, there will be less chance of brain cell damage.)

Hypoglycemia. The dental patient's medical history should indicae possivle occurrences of hypoglycemia. Hypoglycemia may be congenital or acquired. The patient's physician should be contacted if chronic symptoms of hypoglycemia are suspected.

Symptoms of chronic hypoglycemia include extreme fatigue, hunger, pallor, and syncope (fainting). Under stress, possibly in a dental-treatment situation, the patient may suffer clinical symptoms such as fatigue, pallor, sweating, chills, tachycardia, convulsions, and syncope. The hyypoglycemic condition may arise from an excessive amount of insulin in the blood stream when little food has been eaten.

Emergency treatment of the hypoglycemic patient should include positioning for shock. Oxygen may be administered and general treatment for the comfort and warmth of the patient should be given.

If the patient has retained consciousness, sugar may be administered to elevate the glucose level in the blood. A sugar cube may be placed sublingually in the patient's mouth. The physician or dentist may elect to administer an intravenous (I.V.) dose of glucose. The patient will respond to treatment within a few minutes.

The patient should be advised to see a physician soon to determine the extent of his or her condition. Further dental appointments should be arranged to avoid fatigue and stress situations. Morning appointments should be considered.

Epilepsy. Epilepsy is a genetic or pathogenic disorder and is usually characterized by involuntary convulsions of the muscular system. The convulsive seizures may be accompanied by loss of consciousness.

The seizures are categorized in the following manner. *Petit mal* seizures are not too severe and are of brief duration, similar to a short faint. A petit mal patient may have brief periods of staring into space. *Grand mal* seizures are much more severe, with possible loss of consciousness followed by violent contractions of the muscles caused by stimulation to the brain cells controlling the muscular system. These seizures may last several minutes.

Treatment protects the grand mal patient from self-injury during the muscle contractions; also, place an object such as a heavily padded tongue depressor between the patient's teeth to prevent biting the tongue. Padding of the tongue depressor will prevent injury to the tissues of the oral cavity.

When the patient regains consciousness, he or she will be fatigued and will need rest. Do not question the patient. Keep the patient warm and away from onlookers, and attempt to maintain a free airway.

Cardiogenic Shock. Cardiogenic shock is caused by stress on the heart muscle. The patient will complain of pain in the chest. He or she will show stress and will be able to breathe more easily while sitting upright. Give the patient oxygen immediately and call a physician or dentist. The doctor will indicate if the patient is to be transported to the hospital.

Angina Pectoris. Angina pectoris is a severe condition caused by a decreased blood flow to the heart muscle as a result of a narrowing of the coronary artery. The constricting of blood flow causes pain similar to that of a heart attack. The pain is located in the arm and chest. The condition, which may be preceded by agitation, is caused by excitement and the stress of physical exertion.

The angina patient will be more comfortable sitting upright during a seizure. The symptoms of angina also include shortness of breath, extreme anxiety. The patient may also become concerned that he or she must remain sitting up. *Cyanosis* (lack of oxygen, causing the skin to affect a blue tinge) and chest pain are common in attacks of angina. There may also be a swelling of the ankles and hands if the patient has angina.

The angina and the pain may be relieved within 3 to 5 minutes. The patient may be prescribed nitroglycerine tablets. The tablet is placed under the patient's tongue; the medication will be absorbed through the mucous membrane on the floor of the mouth. One nitrogylcerine tablet is given in this manner and may be followed within 20 minutes by at least one more tablet, as prescribed.

Heart Failure. In this disorder, the left atrium of the heart does not function and cannot receive blood from the lungs. The blood backs up into the air sacs of the lungs and into the right ventricle of the heart. The right ventricle does not force blood into the lungs, and oxygen is not passed through the lungs into the blood. The blood recedes into the body.

Heart Attack. A heart attack is due to a heart disease that causes a part of the heart muscle to die. The coronary artery is blocked and deprives part of the heart muscle of fresh blood. The segment of heart muscle not receiving adequate blood deteriorates and causes the heart attack. Death of a portion of the heart muscle might be termed *coronary thrombosis*, *coronary occlusion*, *myocardial infarction*, or *coronary attack*.

The symptoms of heart attack include a feeling of apprehension, severe pain in the chest, shortness of breath, nausea, and perspiration. At onset the pain usually is located at the sternum and left arm, and radiates to the neck and the left side of the chest. It may remain in the chest or back. The patient complains of extreme chest pain, as though he or she were being held in a viselike apparatus which was pressing on his or her chest, affecting his or her breathing.

Emergency treatment for the heart attack patient includes administering oxygen, maintaining the patient at rest in an upright position, and calling a physician *immediately*. Patients with all types of heart conditions are treated in a similar manner:

(1) Keep the patient in a sitting position.

(2) Do *not* allow the patient to attempt to move; move him or her upright only; and make *no* unnecessary movements.

(3) Reassure the patient in quiet tones.

(4) Administer oxygen.

(5) Loosen the patient's clothing.

(6) Cardiopulmonary resuscitation may be indicated.

(7) Stay with the patient; do *not* walk away.

The oxygen and reassurances will cause the patient to be more relaxed and comfortable, which, in turn, will lower anxiety. Oxygen will benefit the cells of the entire body, including those of the brain and the heart. Call a physician or dentist immediately in all cases in which heart attack or heart condition is suspected.

Cerebrovascular Accident (CVA). *Stroke* is caused by accidental damage to the vascular system of the brain. The accident is caused by spontaneous rupturing of the arteries that supply the brain or by a clot that forms in the artery (thrombosis) or an embolus that forms elsewhere and travels to an artery in the brain, causing a blockage.

Stroke patients suffer from the following symptoms: (1) dizziness and confusion as to their surroundings; (2) numbness or paralysis; (3) difficulty in speaking and swallowing; (4) convulsions; (5) loss of consciousness or coma; and (6) loss of control of body functions.

In treating a CVA patient, call a physician immediately. Be calm when observing patients who are suffering a stroke. The patient may be conscious and aware of the surroundings, but unable to talk. You should reassure the patient and make him/her comfortable. Administer oxygen, if necessary.

Exercises (699):

1. Column A below lists some emergency situations that can occur in a dental clinic. Match the emergency listed in column A with its description listed in column B. Use each description only once.

Column A	*Column B*
____ (1) Angioneurotic edema.	a. A heart disease that causes part of the heart muscle to die.
____ (2) Toxic reactions.	b. Caused by accidental damage to the vascular system of the brain.
____ (3) Heart attack.	c. Usually the result of an overdose of a drug.
____ (4) Anesthetic allergy reations.	d. A genetic or pathogenic disorder usually characterized by involuntary convulsions of the muscle system.
____ (5) Cerebrovascular accident.	
____ (6) Angina pectoris.	
____ (7) Epilepsy.	
____ (8) Heart failure.	
____ (9) Diabetic mellitus.	
____ (10) Penicillin allergy reaction.	

Column A	*Column B*
____ (11) Hypoglycemia.	e. Caused by stress on the heart muscle.
____ (12) Cardiogenic shock.	f. Includes allergic reaction, toxic reaction, and hypersensitivity.
	g. A severe condition caused by a decreased blood flow to the heart muscle as a result of a narrowing of the cornary artery.
	h. A form of giant urticaria (hives).
	i. A disease in which the patient is unable to metabolize sugar normally.
	j. May arise from an excessive amount of insulin in the blood stream.
	k. The left atrium of the heart does not function and cannot receive blood from the lungs.
	l. Includes two types of reactions, immediate or anaphylactic; and delayed or serum.

Bibliography

ECI Course

CDC 98150, Volume 3, *Dental Instruments and Materials*. Extension Course Institute, Gunter Air Force Station, Alabama 36118.

Books

Torres and Ehrlich, *Modern Dental Assisting*, 2nd ed. W.B. Saunders Company, West Washington Square, Philadelphia, Pennsylvania, 1980.

Department of Air Force Publications

AFR 162-1, *Management and Administration of USAF Dental Activities*.

Answers for Exercises

CHAPTER 1

Reference:

600 - 1. X-rays allow the dental officer to view areas of the teeth and surrounding structure that cannot be seen in a mouth mirror or during an exploratory examination.
600 - 2. The dentist can view the bone loss and follow the progression of the disease.
600 - 3. By determining if the canal is reamed and filed to the proper length. The dental officer uses radiographs postoperatively to insure the canal is properly filled.
600 - 4. By determining the location of fractured root tips and to verify the complete removal of such root tips.

601 - 1. (1) d.
(2) a.
(3) f.
(4) c.
(5) e.

602 - 1. The cathode and anode.
602 - 2. The tungsten target, copper head, and copper stem.
602 - 3. The tungsten filament and the molybdenum cup.
602 - 4. When low-voltage current heats the tungsten filament to incandescence.
602 - 5. When high-voltage current is passed through the X-ray tube.
602 - 6. They give up their kinetic energy, which reappears or is converted to X-rays and heat.
602 - 7. A high degree of vacuum.
602 - 8. The relatively high voltage across the anode and cathode.
602 - 9. X-rays produced by high voltage are referred to as hard radiation. They have shorter wavelengths and, therefore, a higher penetrating power.

603 - 1. F. It is adequate protection for the operator and patient from the hazards of radiation.
603 - 2. F. They can inflict injury and can cause death to body tissues.
603 - 3. T.
603 - 4. T.
603 - 5. T.
603 - 6. F. It is called secondary radiation.
603 - 7. T.

604 - 1. The walls are adequately shielded to prevent X-rays from passing through them and exposing personnel in adjacent areas.
604 - 2. Away from the tubehead, out of the line of the useful beam, and behind an adequately shielded protective barrier.
604 - 3. A leaded rubber apron.
604 - 4. No.
604 - 5. To protect personnel in adjoining areas from unnecessary exposure to X-radiation.
604 - 6. Commercially available shields.
604 - 7. Damage to the tubehead could result in leakage of radiation.
604 - 8. To measure whole-body radiation.
604 - 9. A message, so stating, is quickly dispatched to the originating Enviromental Health Service. This usually triggers a comprehensive investigation.
604 - 10. Exposing a film badge to direct sunlight, radiant heat, or other types of radiation, could affect the highly sensitive film used in the film badge.
604 - 11. Filtration serves to filter out poor quality, long wavelength radiation that is not of any diagnostic value.
604 - 12. Collimation reduces the useful beam to 2 3/4 inches in diameter at the skin surface. This drastically reduces unnecessary exposure to the patient's eyes and throat area.

605 - 1. Periapical film.
605 - 2. Toward the occlusal or incisal surface; to prevent it from obstructing the view of the apical regions.
605 - 3. Bitewing film.
605 - 4. A general view of the maxillary or mandibular arch.
605 - 5. To allow for different developing times.
605 - 6. Pedodontic.
605 - 7. They must be used to obtain a panoramic view of the oral structures and to view specific facial bones, sinuses, or the temporomandibular joint.
605 - 8. The screen fluroesces when exposed to X-rays. This provides a more intense exposure of the film without increasing the exposure time.
605 - 9. An emulsion, consisting of silver halides in a gelatin.
605 - 10. A latent image.
605 - 11. The film must be immersed in chemicals that cause a reaction that transforms the exposed silver halides into black metallic silver.
605 - 12. Intermediate (medium fast type B) and ultraspeed (super type D).
605 - 13. The film is sandwiched between black protective paper, which in turn is backed by lead foil. These contents are enveloped by a lightproof, waterproof packet.
605 - 14. It prevents secondary radiation from fogging the film.
605 - 15. Because it is not packaged in individual lightproof packets.
605 - 16. In a cool dry place, away from any chemicals. If stored in or near the exposure room, it should be kept in lead-lined containers.
605 - 17. On edge.

606 - 1. To direct the X-ray beam perpendicular to the recording place of the film which has been positioned parallel to the long axis of the tooth.
606 - 2. 16 to 20 inches. With the longer focal (target) film distance, enlargement of the image is reduced.
606 - 3. Exposure time must be increased.

607 - 1. To establish a parallel relationship between the film packet, the stuctures to be radiographed, and the tubehead.
607 - 2. No.
607 - 3. (1) d.
(2) b.
(3) a.
(4) f.
(5) c.
607 - 4. The shielded or printed side.
607 - 5. Hold the right-angled portion of the indicator rod anterior to the block and away from the film. Insert the pins into the proper holes. Slide the locator ring into the indicator so that it is in front of the film packet.

608 - 1. Vertically.
608 - 2. (1) c.
(2) b.
(3) d.
608 - 3. The locator ring.
608 - 4. The extension tube of the X-ray unit.

608 − 5. Place a cotton roll in the space normally occupied by the crowns of the missing teeth.

609 − 1. To reveal the presence of caries in the crowns of teeth, particularly early lesions on the interproximal surfaces.
609 − 2. The median saggital plane must be vertical and the ala-tragus line horizontal.
609 − 3. The film packet should be placed so that its greatest dimension lies in a horizontal plane, parallel with the long axis of the teeth. The forward edge of the film packet should be placed behind the distal one-third of the cuspid teeth. The patient should have his or her teeth closed down on the bite tab to hold the film in position.
609 − 4. The central ray should be directed toward the occlusal plane at the center of the packet. The pointer should read about 8° below the centerline for the proper vertical angulation. Obtain proper horizontal angulation by sighting through the maxillary second biscuspid-first molar contact area.

610 − 1. Many oral conditions from a cross-sectional aspect.
610 − 2. You should have checked items b, c, e, and g.

611 − 1. T.
611 − 2. T.
611 − 3. F. The ala-tragus line is parallel to the floor for maxillary exposures.
611 − 4. T.
611 − 5. F. Have the patient bite down firmly, but gently, on the packet to retain it in position.

612 − 1. (1) c.
(2) a and d.
(3) c and f.
(4) b.
(5) b.
(6) a.
(7) d.
(8) e.
(9) d.
(10) c.

613 − 1. They may be used to obtain a panographic view of the patient's teeth and their surrounding structure or to view a specific bony area where an abnormality is suspected.
613 − 2. The X-ray head and the cassette of the unit rotate around the patient's oral structure.
613 − 3. Because there is some degree of distortion with all panographic radiographs.
613 − 4. By having the patient hold the cassette against the structure to be radiographed and by directing the central ray toward the cassette from the opposite side of the patient's head.

614 − 1. Because the films used in X-ray work are very sensitive to white light.
614 − 2. It should be completely lightproof; if the entrance way is a door, it should have an inside lock; if the entrance is a maze, it should have enough turns to keep out light; and it should have adequate ventilation.
614 − 3. Unwrap a film under the safelight's illumination. Put an object on the film and place it beneath the safelight for 1 minute; then process the film. If the profile of the object is visible on the processed film, the illumination is not safe.
614 − 4. It is a corrosion- and rust-resistant tank that has three compartments. The two smaller compartments are provided for the developer and fixer solution; the larger compartment contains water.
614 − 5. It can be partially controlled by a supply of hot and cold water. After the water is in the tank, a refrigeration unit maintains the proper temperature. If the processing tank is not equipped with a refrigeration unit, the incoming pipes should lead to a mixing valve that will regulate the water flow.
614 − 6. You unwrap the film and feed it into a slot on the automatic developer. A conveyor system transports the film through the developing chemicals and turns out the processed film in about 5 minutes.
614 − 7. The interval timer.

615 − 1. To provide a way of identifying which patient's films are on which rack.
615 − 2. The unwrapping and placing of the film onto the processing rack.
615 − 3. Tiny air bubbles may form on the films' surfaces and, if left uncorrected, portions of the film go underdeveloped. This problem can be prevented by agitating the rack immediately after you place it in the developing solution.
615 − 4. 5 minutes at 68° F.
615 − 5. The left-hand section.
615 − 6. The left-hand section, since the developing time is most critical.
615 − 7. The silver halides, in the film's emulsion, that were affected by the X-rays are converted to black metallic silver by the developer solution.
615 − 8. When it becomes a dark brown color.
615 − 9. Move the film to the center (water) section of the processing tank and agitate the film for 15–30 seconds for the purpose of rinsing off all traces of the developer solution.
615 − 10. The right-hand portion.
615 − 11. 10 minutes.
615 − 12. At least 20 minutes.
615 − 13. 100° F.

616 − 1. They should be mounted in the same sequence as the teeth appear in the mouth and for viewing the lingual aspect.
616 − 2. From the embossed dot on the corner of the film. If you are looking into the depression, you are viewing the film from the lingual aspect.
616 − 3. (1) d and e.
(2) a.
(3) b and c.
(4) e and f.
(5) b.
616 − 4. Maxillary incisors and cuspids appear larger than their mandibular counterparts; maxillary molars have three roots, whereas mandibular molars have only two; and the shape and position of the teeth.

617 − 1. Detail refers to the sharpness of the image; density refers to the degree of blacking of the film; and contrast refers to the difference between the black, white, and various shades of gray on the film.
617 − 2. (1) c.
(2) g.
(3) m.
(4) i.
(5) b.
(6) k.
(7) f.
(8) l.
(9) a.
(10) j.
(11) h.
(12) d.
(13) e.

618 − 1. The dental X-ray analyzer check is a quick, simple method to determine if the dental X-ray unit is making accurate exposures using the correct amount of radiation.
618 − 2. It can also be used to check for defective film, improper methods of processing, and poor processing solutions.
618 − 3. Before your first patient arrives. You will need an unexposed periopical film packet; an X-ray analyzer; a dental X-ray unit; a dental radiographic processor; and the analyzer standard.
618 − 4. Place a new unexposed periopical film packet (front up) on the arm or seat of the X-ray chair. Carefully rest the analyzer cartridge on top of the film packet, making sure that the film is completely covered. Next, turn on the dental X-ray unit and set the controls according to those required by the analyzer's manufacturer. Then place the end of the X-ray cone so that it is parallel and directly over the analyzer and film. Finally, expose and process the film as you normally would.
618 − 5. Check the film expiration date, and recheck the dental X-ray unit's controls and the processor's chemicals/temperature.

618 – 6. Only after the check has shown that all equipment is working properly.

CHAPTER 2

619 – 1. (1) Prevent the occurrence, progression, and recurrence of oral disease; (2) help patients establish a healthy oral environment; (3) teach each patient how to maintain a healthy oral environment; (4) and facilitate patient self-learning and the acceptance of personal responsibility.
619 – 2. A clinical phase,, a community health phase and a dependent children phase.
619 – 3. All dental personnel should participate.
619 – 4. Through the organized continuing education program on the base and through the proper local state and national professional meetings.

620 – 1. A checkmark should be by the following: a, c, d, e, and f.
620 – 2. To insure the currency of the dental health classification, early detection of oral pathology, and proper custody of the dental health record.
620 – 3. Plaque control techniques, home care, the use of adjunctive oral hygiene devices, diet and nutrition, and general dental health.
620 – 4. No.

621 – 1. To complement and reinforce the clinical phase by promoting good oral health habits in the Air Force community.
621 – 2. Where children are in residence and where approval has been obtained from Headquarters USAF.
621 – 3. Because it directly relates to the water consumption rate of the local populations.
621 – 4. To improve the oral health habits of the Air Force community, your goal is to educate them through the judicious use of ethical publicity.
621 – 5. When repeated periodically.
621 – 6. You can obtain assistance from your base education and training personnel who are responsible for training aids and graphics.
621 – 7. Overt or implied endorsement of the commercial product.
621 – 8. The principal items required for good oral hygiene; namely, the toothbrush and unwaxed dental floss.

622 – 1. AFR 162-1.
622 – 2. To evaluate the patient's history and determine if disease exists that would preclude the application of an anticariogenic agent.
622 – 3. If staffing and workload permit.
622 – 4. If the patient is located where dental care for family members is authorized.
622 – 5. The base medical service, school authorities, and the school nurse.

623 – 1. Establish your objectives, select a method of presentation, and prepare the lesson plan.
623 – 2. It permits the speaker to present many ideas in one presentation, and it is a convenient method for presenting information to large groups.
623 – 3. It limits audience participation, makes it difficult to evaluate the audience's understanding, and does not hold the audience's attention as well as other methods.
623 – 4. It is time consuming and limited to people having enough basic knowledge to make the discussion worthwhile.
623 – 5. It tells and shows the audience how to perform.
623 – 6. It provides for individual guidance and evaluation of each person and it allows the audience to apply their knowledge to practical situations.
623 – 7. It is time consuming and requires a higher trainer to student ratio than the other methods.
623 – 8. To gain the audience's attention, provide motivation, and present an overview of what is going to be covered.
623 – 9. You must organize logically the main points of your lesson.
623 – 10. A summary, remotivation, and a closure.

624 – 1. They can help to clarify directions and explanations.
624 – 2. Be certain to write large enough, plain enough, and slowly enough. Do not clutter the whole board, do not erase too quickly, and stand to the side so that the board can be seen. Also, talk to the audience and not to the board.
624 – 3. To present pertinent facts, statistics, directions, and procedures.

625 – 1. Prior to the scheduled presentation time.
625 – 2. By varying the pitch, rate, and force of your voice.
625 – 3. Interest of the audience and, also, enables you check for signs of doubt, confusion, or boredom.
625 – 4. To the desired objectives.

626 – 1. T.
626 – 2. T.
626 – 3. F. Raise the chair so that the patient's mouth is approximately at your elbow.
626 – 4. T.
626 – 5. F. The patient should not have to stretch to reach the cuspidor.
626 – 6. T.
626 – 7. T.
626 – 8. F. It aids in the detection of subgingival calculus.
626 – 9. F. Bring any conditions that might be a contraindication to prophylaxis to the attention of the dental officer.
626 – 10. F. You should discuss all "yes" answers on the AF Form 696, Dental Patient Medical History.
626 – 11. T.
626 – 12. T.
626 – 13. T.
626 – 14. T.
626 – 15. F. Have the patient chew the tablet and then swallow.

627 – 1. To remove calculus from the tooth surfaces.
627 – 2. To eliminate the source of irritation to the periodontium.
627 – 3. The amount of calculus present in the patient's mouth.
627 – 4. The ultrasonic prophylaxis unit.
627 – 5. Hand instruments.

628 – 1. When the vibrations have reached their highest pitch—20,000 to 25,000 vibrations per minute.
628 – 2. 35 cc per minute.
628 – 3. A gentle, short, rapid, massagelike stroke.
628 – 4. Flat-hoe chisel scaler (P–3).
628 – 5. In any area of the mouth.

629 – 1. Currettes are less traumatic to the hard structures, cementum, and supporting structures of the teeth. You can do subgingival scaling with minimal discomfort to the patient and minimal damage to his or her soft tissues and teeth.
629 – 2. So that you can use one instrument of the pair to scale the mesial of a tooth and the other instrument to scale the distal of the tooth.
629 – 3. Anterior teeth.
629 – 4. Bicuspids.
629 – 5. The *Gracey* No. 11 and No. 12.
629 – 6. To determine the presence, form, and depth of periodontal pockets.
629 – 7. As a retractor of the patient's tongue and cheek.

630 – 1. (1) Pen, (2) modified pen, and (3) palm grasp.
630 – 2. The palm grasp.
630 – 3. The third or fing finger.
630 – 4. The palm grasp.

631 – 1. F. It will vary with the individual patient's needs.
631 – 2. F. The ultrasonic prophylaxis unit is particularly useful for performing the gross scaling.
631 – 3. T.
631 – 4. T.
631 – 5. F. Try to use each instrument in all the areas indicated by its design before changing to another instrument.

632 – 1. Lower; heart.
632 – 2. Mouth mirror.
632 – 3. Weight; feet.
632 – 4. Good posture; back straight.

633 – 1. Irritation would impede your efforts to rehabilitate and educate the patient toward improved oral hygiene.
633 – 2. So that you do not injure the tooth or its surrounding tissues.
633 – 3. By frequently irrigating the scaling site.
633 – 4. Too vigorous a retraction can be extremely uncomfortable to the patient.

633 – 5. Dull instruments produce inadequate results, waste time and effort, and are hard to control.
633 – 6. Use color tape.
633 – 7. You appear to be unsure of yourself and the patient could easily lose confidence in you.
633 – 8. Because blood or debris from your hands or the instrument could stain the patient's clothing.

634 – 1. Disclosing chemicals.
634 – 2. Into the gingival sulcus.
634 – 3. Your sense of touch.
634 – 4. A rough texture.
634 – 5. The concave grooves leading into the furcation areas of multirooted teeth.

635 – 1. F. The horizontal stroke parallels the cervical line and is usually used to remove deposits from the facial and lingual surfaces of the teeth.
635 – 2. T.
635 – 3. T.
635 – 4. F. The first phase is the exploratory stroke.
635 – 5. F. You should establish your finger rest on a dry, firm tooth structure as close as possible to the tooth being scaled.
635 – 6. T.
635 – 7. T.
635 – 8. F. You should avoid independent finger movements which cause fatigue.
635 – 9. T.
635 – 10. T.
635 – 11. T.
635 – 12. F. Whenever possible, remove the whole thickness of calculus in one piece.

636 – 1. To remove stains and plaque and to create a smooth surface.
636 – 2. Hand instruments.
636 – 3. Three percent hydrogen peroxide or stannous fluoride.
636 – 4. Use a rubber cup attached to a prophylaxis handpiece or to a conventional speed contra-angle handpiece.
636 – 5. Rotate the polishing cup or brush moving over the tooth's surface. Also, use low speed and light pressure.
636 – 6. Because the rotation of the cup or brush can sling polishing material out of the patient's mouth and into your eyes.
636 – 7. Waxed floss.
636 – 8. Because the fibers separate and plaque is removed more easily from the tooth surfaces.
636 – 9. Call it to the attention of a dental officer or make a note of this finding in the remarks section of the patient's dental record. Overhanging restorations are a prime source of gingival irritation, and they should be promptly corrected.

637 – 1. 80 gm.
637 – 2. Flavoring.
637 – 3. 2; 3.
637 – 4. Professional supervision. Self-use.
637 – 5. Scaling.
637 – 6. Equal; distilled water.
637 – 7. Isolating; drying; 30 seconds.
637 – 8. Eat, drink, or rinse his or her mouth.
637 – 9. 6; 12.

638 – 1. Hydrocolloid impression material.
638 – 2. Hydrocolloids do not adhere to other substances.
638 – 3. Alginate.
638 – 4. Alginate-type hydrocolloid impression materials are influenced by shrinkage, expansion, strain, and stress.
638 – 5. Its strength.
638 – 6. The temperature.
638 – 7. Heat accelerates the set; cold retards the set.

639 – 1. (1) A rimlock tray; (2) a rubber bowl; and (3) a spatula.
639 – 2. One that is fairly flexible.
639 – 3. A wide and slightly flexible spatula.
639 – 4. It should allow from 1/8 to 1/4 inch of space around all surfaces of the teeth and be from 1/8 to 1/4 inch distal of the maxillary tuberosity.

640 – 1. Rinse the rubber bowl with distilled water (65° F. to 72° F.). Also, remove all the water from the bowl.
640 – 2. According to the manufacturer's directions.
640 – 3. The powder should be poured into the water.
640 – 4. Folding.
640 – 5. 60 seconds.

641 – 1. Impression material.
641 – 2. Occlusal; facial.
641 – 3. Sideways, circular, straightening.
641 – 4. Tuberosity; posterior teeth.
641 – 5. Facially; mucus.
641 – 6. Mucus; saliva; surface.
641 – 7. Distort.

642 – 1. T.
642 – 2. T.
642 – 3. T.
642 – 4. F. Fill the tray from one terminal molar area so that the stone goes from one tooth to the next around the arch.
642 – 5. F. Allow the mixture to set with the tray in a horizontal position.
642 – 6. F. The initial set takes from 7 to 15 minutes.
642 – 7. T.
642 – 8. T.
642 – 9. F. Shape the patty so that it is 1/2 inch thick.
642 – 10. F. Invert the hardened model onto the patty and allow to set for 45 minutes.
642 – 11. T.
642 – 12. F. If you must rinse the cast, use slurry water.

643 – 1. First, trim the working cast so that you can pull the mouthguard material over all of the teeth and into the muco-buccal fold. Then use a roach carver and score the cast horizontally at the point where the soft tissue meets the attached gingiva.
643 – 2. A pair of scissors; a pan of water; a unit to heat the water to 180° to 200° F., instrument to handle the hot material; and a unit to provide a vacuum.
643 – 3. Remove the excess material and smooth rough edges.
643 – 4. Alcohol torch, laboratory knife or scissors, and a lathe, equipped with an arbor band.
643 – 5. When the cloudy appearance vanishes and the material appears clear.
643 – 6. First, you can make a normal adult cast with only half a sheet of material; second, the material is evenly adapted over the biting surfaces of the teeth.

644 – 1. The bacteria found in the mouth.
644 – 2. Any microorganism.
644 – 3. A bit of living jelly with a clear membrane surrounding it.
644 – 4. They occupy an intermediary position between animals and plants with some properties of both.

645 – 1. Saprophytes.
645 – 2. Parasites.
645 – 3. Virulent.
645 – 4. Anaerobic; sulcus.
645 – 5. Retain.

646 – 1. (1) m.
(2) l.
(3) k.
(4) j.
(5) i.
(6) h.
(7) g.
(8) f.
(9) e.
(10) d.
(11) c.
(12) b.
(13) a.

647 – 1. Each bacterium increases rapidly by dividing into two bacteria.
647 – 2. By providing warm moisture.
647 – 3. By providing a mechanical means of removing bacteria from the mouth, either by expectorating or by swallowing.
647 – 4. Aerobic bacteria.
647 – 5. Anerobic.

648 – 1. So that you can observe his or her responses to the various portions of your counseling and have better rapport.
648 – 2. The disclosing agent.
648 – 3. Never chastise patients for their past neglect. Your job is to educate and encourage them to improve their oral hygiene.

649 – 1. How to clean their mouths properly.
649 – 2. An almost invisible film of water, containing cells and millions of living bacteria.
649 – 3. At least once in every 24-hour period.
649 – 4. (1) Have better health, (2) retain your natural appearance, (3) enjoy chewing and talking, and (4) prevent bad breath.

650 – 1. It foams and prevents you from seeing if the brush is placed properly.
650 – 2. It should be soft and multitufted with nylon bristles, a straight, rigid plastic handle, and a small, flat head.
650 – 3. Vibratory strokes.
650 – 4. Unwaxed dental floss.
650 – 5. Your two forefingers.
650 – 6. Saw it back and forth at the point where the teeth touch each other. Let it slide gently into place.
650 – 7. To remove the food particles and plaque that you have loosened.

651 – 1. Use a disclosing agent.
651 – 2. Medicated dentifrices and mouthwashes are prescribed.
651 – 3. One that contains fluoride. Only *after* all plaque has been removed.
651 – 4. After meals.

CHAPTER 3

652 – 1. Physically; chemically.
652 – 2. Enzymes.
652 – 3. Styalin.
652 – 4. Pharnyx; esophagus.
652 – 5. Muscular contractions.
652 – 6. Chyme.
652 – 7. Type; amount.
652 – 8. Proteoses; peptones.
652 – 9. Duodenum; bile; pancreas.
652 – 10. Emulsification; digestion.
652 – 11. Carbohydrates; proteins; fats.

653 – 1. The process by which the end products of digestion pass through the lining of the small intestine into the blood and lymph systems.
653 – 2. Simple sugars.
653 – 3. The stomach.
653 – 4. The small intestine.
653 – 5. They attack plant fiber in the chyme, bringing about further breakdown of this indigestible matter. They are also important in synthesizing some of the vitamins essential to the body.
653 – 6. It is changed from a liquid to a semisolid state.

654 – 1. Metabolism is the chemical process of either changing the absorbed foods into complex tissue elements, or transforming complex body elements into simple ones, along with the production of heat and energy.
654 – 2. Proteins, fats, and carbohydrates.
654 – 3. Four.
654 – 4. During the first 2 years of life.
654 – 5. Increase.
654 – 6. The energy output.
654 – 7. Between 2,200 and 3,200 calories.

655 – 1. Amino acids.
655 – 2. Nine.
655 – 3. Cell proteins.
655 – 4. Hemoglobin.
655 – 5. Blood plasma.
655 – 6. Carbohydrates; fats.

656 – 1. In the stomach.
656 – 2. A group of enzymes secreted by the intestinal mucosa.
656 – 3. Those needed for synthesis and repair; those needed for manufacturing regulatory products.
656 – 4. They are deaminized by the liver.

657 – 1. T.
657 – 2. T.
657 – 3. F. Complete proteins are usually found in animal sources.
657 – 4. T.
657 – 5. T.
657 – 6. F. Dairy products provide greater amounts of the essential amino acids than do proteins from plant sources.

658 – 1. (1) Simple and double sugars, (2) starches, and (3) cellulose.
658 – 2. Cellulose.
658 – 3. Simple sugar.
658 – 4. To furnish a direct and immediate source of energy to the tissues of the body.
658 – 5. Fats are oxidized too fast.
658 – 6. It remains in the intestine long enough to promote bacterial growth, which is important in forming such vitamins as vitamin K and niacine.

659 – 1. Absorbed; intestine.
659 – 2. Cooking, heating; digestive enzymes.

660 – 1. By the action of insulin, which is produced and secreted by the pancreas.
660 – 2. It is converted to glucose, as needed; and the glucose is released by the liver to maintain a specific level of glucose in the blood.
660 – 3. Carbon dioxide and water.
660 – 4. It is converted to fatty tissues.

661 – 1. (1) Easily digested and almost completely absorbed; (2) an economical energy source; (3) can be stored as glycogen in the liver; (4) spare protein for its more important functions; and (5) enhance the palatability of the diet.
661 – 2. The excess of carbohydrates irritates the stomach and intestines; causes fermentation and gas formation in abnormal conditions; dulls the appetite for other important foods; and causes tooth decay.
661 – 3. Corn syrup is a source of sugar.
661 – 4. Starch.

662 – 1. Fatty acids.
662 – 2. Saturated; unsaturated.
662 – 3. Carbon; hydrogen.
662 – 4. Saturated.
662 – 5. Monounsaturated.

663 – 1. To aid in the transport of a portion of consumed fatty acids.
663 – 2. Thiamine and niacin.
663 – 3. Vitamins A, D, E, and K.
663 – 4. Eczema and other skin disturbances.

664 – 1. In the intestinal tract.
664 – 2. They must be split into smaller droplets.
664 – 3. Bile and the enzymes of the pancreas.
664 – 4. It cannot be digested or absorbed in the body, and it interferes with the absorption of fat-soluble vitamins.

665 – 1. Some fats are burned for energy and others are stored as body fat to be used later as a source of energy.
665 – 2. They accumulate in the bloodstream and are excreted in the urine.
665 – 3. (1) When the dietary carbohydrate is very low and the level of fat is high; (2) during extreme caloric restriction; or starvation, and (3) when there is disturbance in carbohydrate metabolism.

666 – 1. They produce obesity and the excess fatty tissue around the heart, kidneys, and liver impairs their functions.
666 – 2. 20 to 40 percent.

667 – 1. Strength; hardness; phosphorus.
667 – 2. Proper clotting; contraction; iron.
667 – 3. 0.8.

668 – 1. Poor tooth structure, stunted growth, and fragile bones.
668 – 2. Muscle twitches, cramps in the legs and feet, insomnia, irritability, and nervousness.
668 – 3. Kale, mustard, and turnip greens.

669 – 1. Movement; multiplication.
669 – 2. Carbohydrates; fats.

669 − 3. Protein; calcium.
669 − 4. Yolk; whole grain.

670 − 1. Allows hemoglobin to transport oxygen from the lungs to the body tissues, and allows hemoglobin to carry carbon dioxide back to the lungs.
670 − 2. (1) For growing children to meet their expanding blood supply; (2) to balance losses occuring during menstruation; (3) during pregnancy and lactation to meet development needs of the infant; and (4) building a reserve supply of iron, which can be used during sudden hemorrhaging or blood loss.

671 − 1. Light in color and smaller than normal red blood cells.
671 − 2. With enriched cereals and breads.
671 − 3. Liver.
671 − 4. Egg yolk, vegetables, meat purees, and fortified cereals.

672 − 1. It forms thyroxine, which controls the functions of the thyroid gland.
672 − 2. 100 μg.
672 − 3. Goiter.
672 − 4. The neck becomes distorted because of thyroid gland enlargement.
672 − 5. Salt iodized with 1 percent iodine.

673 − 1. To maintain the proper water balance in the body.
673 − 2. To preserve normal muscle response to stimulation.
673 − 3. 2 to 6 grams.
673 − 4. Table salt.

674 − 1. To maintain a proper balance between the cellular and extracellular fluids.
674 − 2. Cell metabolism, enzyme reactions, and the building of muscle protein from amino acids in the blood.
674 − 3. Approximately 4 grams.
674 − 4. Because it is found widely in natural plant foods.
674 − 5. Milk, milk products, nuts, and many fruits and vegetables.

675 − 1. (1) c.
(2) e.
(3) d.
(4) f.
(5) b.
(6) a.
(7) g.

676 − 1. Building; growth.
676 − 2. 5,000.
676 − 3. Pregnancy; lactation.
676 − 4. Night blindness; dim light; glare.
676 − 5. Appetite; itching, long bones.
676 − 6. Fish-liver oil.
676 − 7. Carotene.

677 − 1. F. It does not reduce the body's need for calcium; it only assists in the proper use of calcium.
677 − 2. T.
677 − 3. F. The *Recommended Dietary Allowances* lists 400 I.U. daily during growth and development periods.
677 − 4. T.
677 − 5. T.
677 − 6. T.

678 − 1. Its antioxidant properties. Vitamin E helps to prevent the deterioration caused by oxidation in certain foodstuffs.
678 − 2. 15 I.U.
678 − 3. When diets are grossly deficient in many other nutrients.
678 − 4. Oils of the wheat germ, cottonseed, rice germ, and germs of other seeds.

679 − 1. Promoting the clotting of blood.
679 − 2. The liver.
679 − 3. 1 to 2 mg.
679 − 4. Reduces the ability of the blood to clot, prolongs the clotting time, and increases the possiblity of hemorrage.
679 − 5. Spinach, cabbage, kale, and the green leaves of cauliflower.

680 − 1. Dentin; connective.
680 − 2. Amino; metabolism.
680 − 3. 60.
680 − 4. Tender; bleed; swell; weaken.
680 − 5. Citrus fruits.
680 − 6. Oxidize.
680 − 7. Alkalinity.

681 − 1. Certain enzyme actions in the metabolism of carbohydrate.
681 − 2. Because of its association with the nervous system in preventing irritability and depression.
681 − 3. Their caloric intake.
681 − 4. Age, degree of activity, growth, pregnancy, and lactation.
681 − 5. Beriberi.
681 − 6. Loss of appetite, fatigue, irritability, depression, gastric distress, and constipation.
681 − 7. Grain products.

682 − 1. Both are essential to the enzyme actions in the body's metabolism.
682 − 2. 1.6 mg for men and 1.2 mg for women.
682 − 3. Skin changes such as cracks in the corners of the mouth, inflammation of the lips and tongue, scaliness around the nose and ears, itching and burning of the eyes, blurred vision, and sensitivity to light.
682 − 4. Milk, cheese, and other dairy products, with the exception of butter.

683 − 1. Release of energy in the body.
683 − 2. The carbohydrate value.
683 − 3. None of the enzyme systems involved with carbohydrate metabolism can function properly. Changes also occur in the gastrointestinal track, skin, and nervous system.
683 − 4. Meats, poultry and fish.
683 − 5. Fruits.

684 − 1. (1) b.
(2) d.
(3) a.
(4) c.

685 − 1. Chemical.
685 − 2. Digestion.
685 − 3. Nutritive; carbon dioxide; waste material.
685 − 4. Evaporation.
685 − 5. 75.
685 − 6. Oxidation.

686 − 1. When the amount of water taken in equals the amount of water emitted.
686 − 2. Intravenous saline and/or glucose solutions.
686 − 3. 1,440 to 1,920 ml (6 to 8 cups) per day.

687 − 1. To provide bulk to stimulate the peristaltic action that causes waste products to pass down the intestinal tract at a normal rate of speed.
687 − 2. The emptying of the stomach is delayed, the flow of gastric acid increases and the walls of the stomach and intestines are irritated.
687 − 3. Leafy vegetables, fruits, and whole grain breads and cereals.

688 − 1. Calcium, riboflavin, and high-quality protein.
688 − 2. 1 quart or more.
688 − 3. 1/2 cup.

689 − 1. 2 to 3 oz.
689 − 2. One cup of dry beans, dry peas, lentils, nuts, and peanuts, and 4 tablespoons of peanut butter.
689 − 3. Two servings.

690 − 1. Four or more.
690 − 2. (1) g.
(2) F.
(3) G.
(4) G.

691 − 1. Whole or processed grains.
691 − 2. Sources of food energy.

692 − 1. Calories.
692 − 2. Bulk.

CHAPTER 4

693 – 1. F. Seek the aid of a dentist or a physician as soon as possible.
693 – 2. T.
693 – 3. T.
693 – 4. F. Never administer liquids by mouth to an unconscious patient since the swallowing mechanism is not efficient.
693 – 5. F. First, asphyxiation; second, hemorrhage; third, shock.
693 – 6. T.

694 – 1. (1) f.
(2) h.
(3) g.
(4) d.
(5) b.
(6) a.
(7) c.
(8) e.

695 – 1. An apparatus for dispensing oxygen.
695 – 2. In each DTR so that a clean mask may be placed quickly on the oxygen unit when needed.
695 – 3. The administration of supplemental oxygen with positive pressure.
695 – 4. So as to deliver a flow of 5 to 10 liters of oxygen per minute to the patient's lungs.

696 – 1. Near the surface of the skin.
696 – 2. Adult, 60 to 80 heartbeats per minute; child, 80 to 100 heartbeats per minute.
696 – 3. The breathing will be rapid, shallow, and labored, particularly if there is an obstruction of the airway of if the patient has heart disease.
696 – 4. If this is determined, it should be noted on the patient's AF Form 696.
696 – 5. Systolic pressure is the highest pressure exerted on the circulatory system.
696 – 6. Diastolic pressure is the lowest pressure of the circulatory system.
696 – 7. It indicates the pulse pressure, which is the volume of blood the heart forces into the aorta during each contraction.
696 – 8. The disc of the stethoscope is placed over the brachial artery at the inner area of the elbow on the upper arm.

697 – 1. (1) c.
(2) d.
(3) a.
(4) b.
(5) f.
(6) e.
697 – 2. Epinephrine 1:1000 in a dose of 0.5 ml.
697 – 3. It will relieve distress and should be administered along with the antiallergic drug.

698 – 1. When the patient is not moving sufficient air into and out of his or her lungs.
698 – 2. Breathing is maintained by one person by artificial means for another person.
698 – 3. Place the patient in a supine position; extend the neck; tilt the head backward; draw the chin downward; retrieve any foreign material in the mouth or throat with the fingers; and remove any prosthesis, if it is likely to drop free of the dental arch.
698 – 4. Mouth-to-mouth; mouth-to-nose; and use of an S-shaped plastic tube inserted at the back of the tongue into the pharynx.
698 – 5. Chest rising.
698 – 6. If the patient's mouth is severely injured or the teeth are missing.
698 – 7. When a patient is unconscious.
698 – 8. The heart has stopped beating and the patient has stopped breathing.
698 – 9. Ventricular standstill, asystole; ventricular fibrillation; and cardiovascular collapse.
698 – 10. No perceptible breathing; no pulse in wrist carotid artery of neck, or femoral artery in the groin; no heartbeat; and dilated pupils.
698 – 11. Airway, breathing, and circulation.
698 – 12. The carotid pulse should be checked immediately.
698 – 13. Ventilation (artificial respiration).
698 – 14. 5:1 (5 chest compressions to 1 lung inflation).
698 – 15. 15:2 (15 chest compressions to 2 lung inflations).
698 – 16. A sufficient amount of oxygenated blood is *NOT* reaching the brain.
698 – 17. Injury to the liver or spleen.

699 – 1. (1) h.
(2) c.
(3) a.
(4) f.
(5) b.
(6) g.
(7) d.
(8) k.
(9) i.
(10) l.
(11) j.
(12) e.

1984-746-037/2247 AUGAFS,AL(843430)1500

98150 00 S03 8411

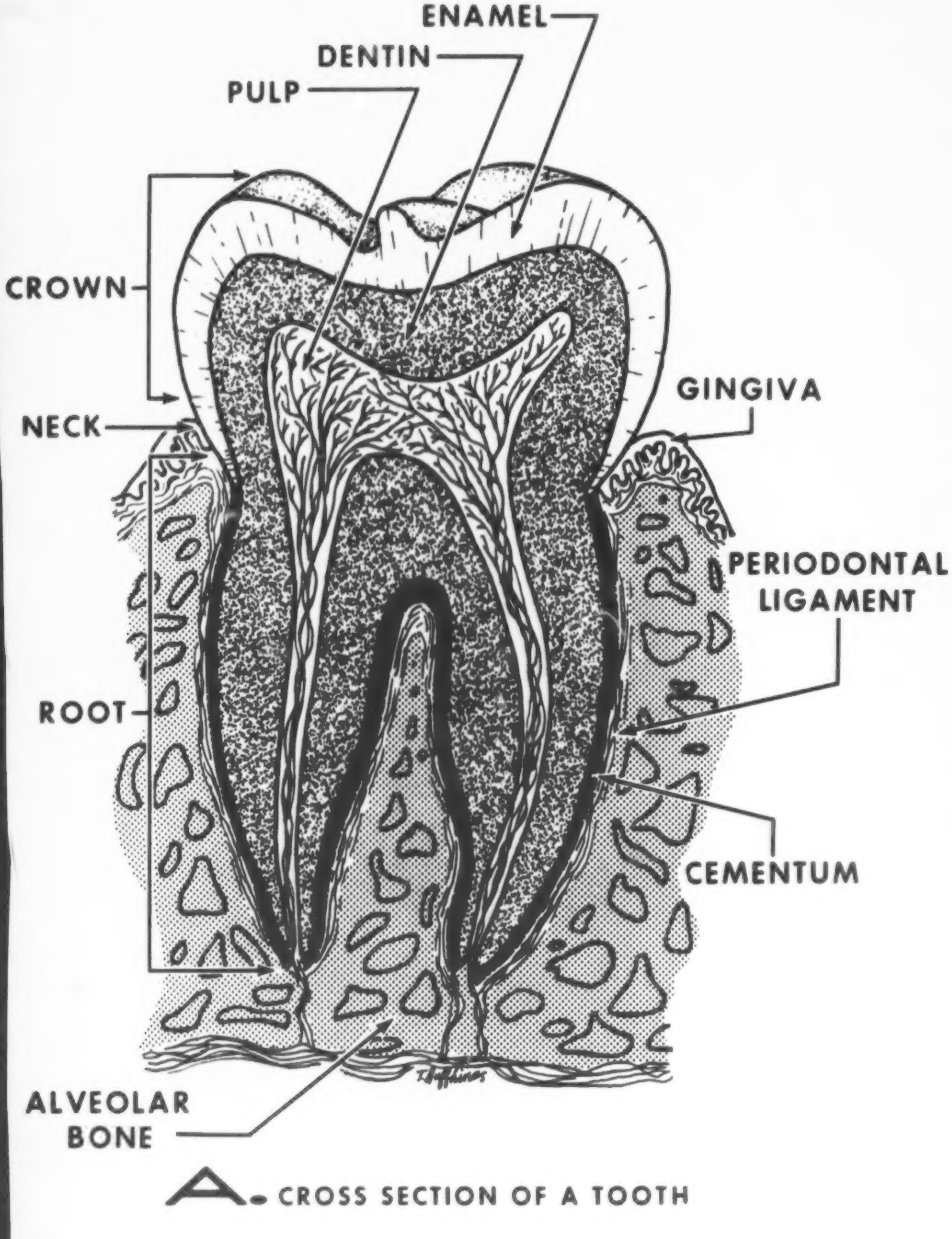
SUPPLEMENTARY MATERIAL

CDC 98150

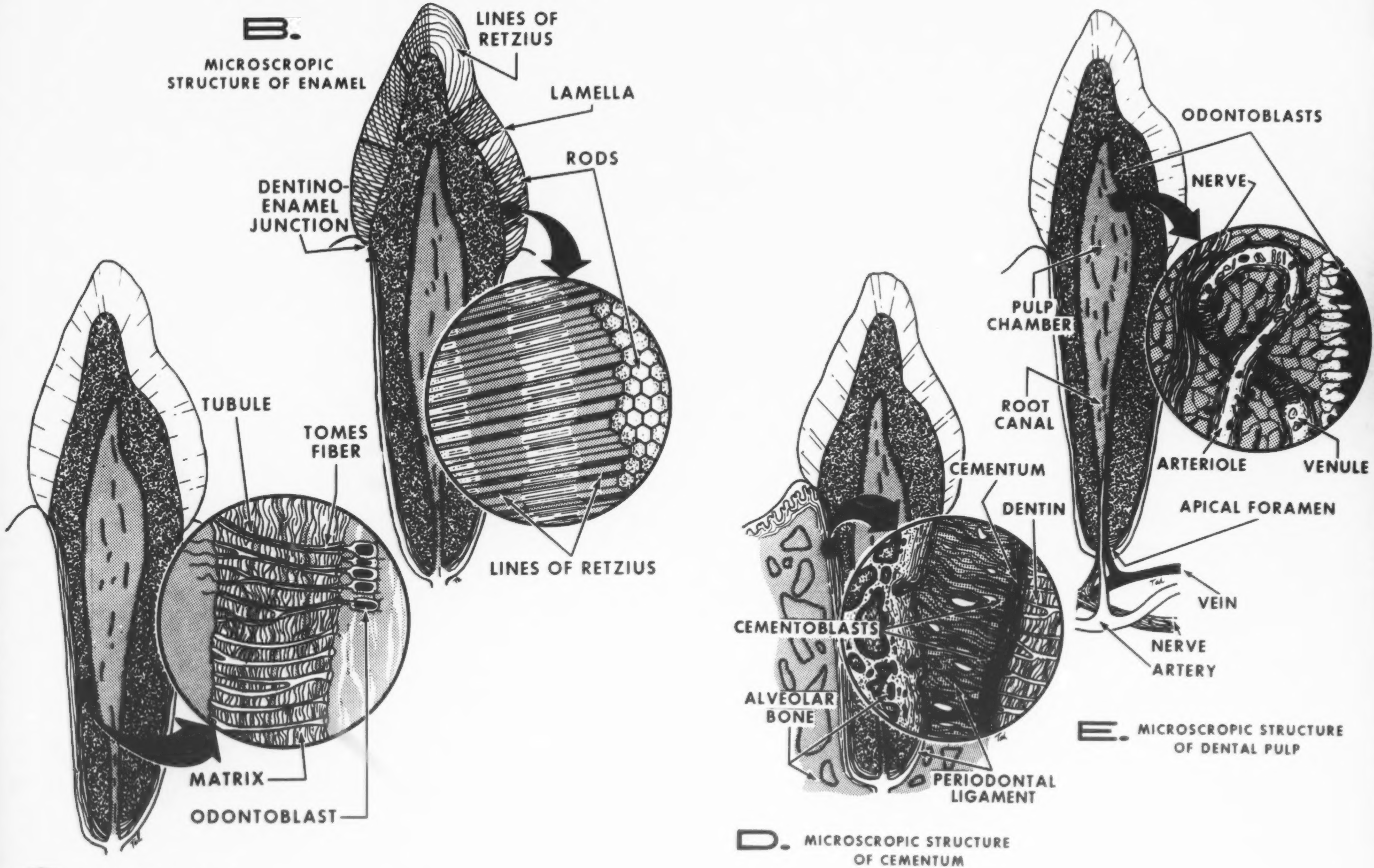
DENTAL ANATOMY, PATHOLOGY, ADMINISTRATION, INSTRUMENTS AND MATERIALS

IMPORTANT: This supplement contains replacement Foldouts 5 and 6 for Supplement 98150 00 S01 8408. They are three-hole-punched and perforated so that you can tear them out and insert them in the supplement.

Extension Course Institute
Air University


ENAMEL
DENTIN
PULP
CROWN
NECK
GINGIVA
PERIODONTAL LIGAMENT
ROOT
CEMENTUM
ALVEOLAR BONE
T. Hopkins

A. CROSS SECTION OF A TOOTH


LINES OF RETZIUS
LAMELLA
RODS
DENTINO-ENAMEL JUNCTION
LINES OF RETZIUS
TUBULE
TOMES FIBER
MATRIX
ODONTOBLAST
CEMENTUM
DENTIN
CEMENTOBLASTS
ALVEOLAR BONE
PERIODONTAL LIGAMENT
ODONTOBLASTS
NERVE
PULP CHAMBER
ROOT CANAL
ARTERIOLE
VENULE
APICAL FORAMEN
VEIN
NERVE
ARTERY

B. MICROSCROPIC STRUCTURE OF ENAMEL

C. MICROSCROPIC STRUCTURE OF DENTIN

D. MICROSCROPIC STRUCTURE OF CEMENTUM

E. MICROSCROPIC STRUCTURE OF DENTAL PULP

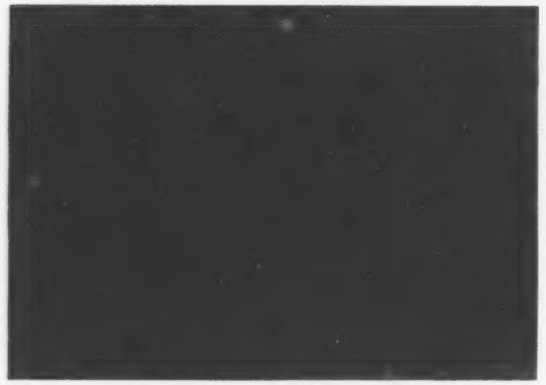
Foldout 5. Anatomical structures of the teeth.

Amalgam Tattoo

Angular Chelosis

Apthous Stomatitis

Candidosis



Caries

Dilantin Hyperplasia

Epulis Fissuratum

Fibroma

Fordyce Granules

Geographic Tongue

Herpes Labialis

Leukoedema

Leukoplakia

Mucocele

Nicotine Stomatitis

Hairy Tongue

Manibular Tori

NUG

Palate Tori

Papillary Hyperplasia

Papilloma

Pericoronitis

Peripheral Giant Cell Granuloma

Primary Herpetic Stomatitis

Pyogenic Granuloma

Squamous Cell Carcinoma

Foldout 6. Oral pahology.

98150 00 S01 8408

SUPPLEMENTARY MATERIAL

CDC 98150

DENTAL ANATOMY, PATHOLOGY, ADMINISTRATION, INSTRUMENTS AND MATERIALS

Volumes 2 and 3

Foldouts 1 through 19

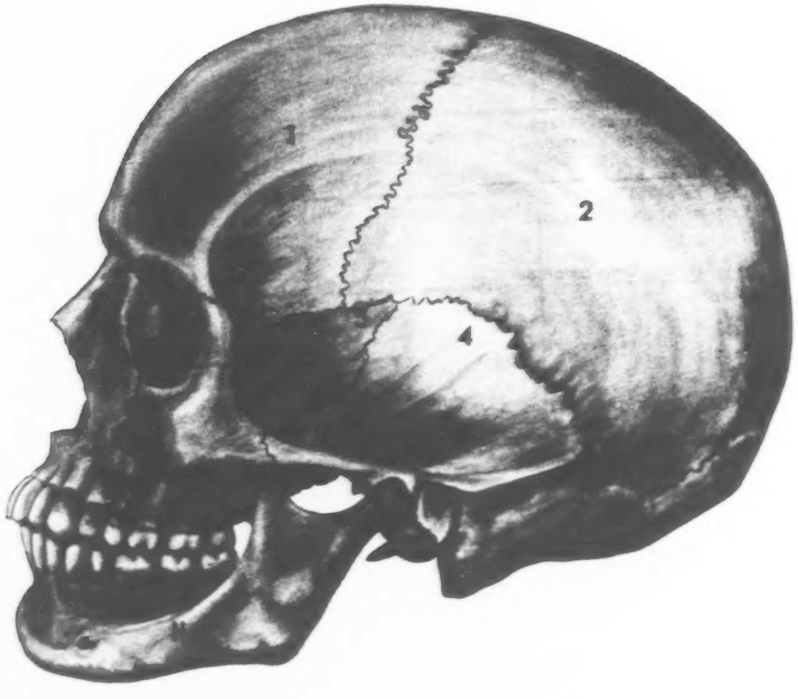
AUGAFS, AL (843651) 1500

Extension Course Institute
Air University

Part of Body	Name of Bone	Number	Identification
Skull (28 bones)			
Cranium (8 bones)			Cranium forms floor for brain to rest on and helmetlike covering over it
	Frontal	1	Forehead bone; also forms most of roof of orbits (eye sockets) and anterior part of cranial floor
	Parietal	2	Prominent, bulging bones behind frontal bone; form topsides of cranial cavity
	Temporal	2	Form lower sides of cranium and part of cranial floor; contain middle and inner ear structures
	Occipital	1	Forms posterior part of cranial floor and walls
	Sphenoid	1	Keystone of cranial floor; forms its midportion; resembles bat with wings outstretched and legs extended downward posteriorly; lies behind and slightly above nose and throat; forms part of floor and sidewalls of orbit
	Ethmoid	1	Complicated irregular bone that helps make up anterior portion of cranial floor, medial wall of orbits, upper parts of nasal septum, and sidewalls and part of nasal roof; lies anterior to sphenoid and posterior to nasal bones
Face (14 bones)	Nasal	2	Small bones forming upper part of bridge of nose
	Maxillary	2	Upper jaw bones; form part of floor of orbit, anterior part of roof of mouth, and floor of nose and part of sidewalls of nose
	Zygomatic (malar)	2	Cheekbones; form part of floor and sidewall of orbit
	Mandible	1	Lower jawbone; largest, strongest bone of face
	Lacrimal	2	Thin bones about size and shape of fingernail; posterior and lateral to nasal bones in medial wall of orbit; help form sidewall of nasal cavity, often missing in dry skull
	Palatine	2	Form posterior part of hard palate, floor, and part of sidewalls of nasal cavity and floor of orbit
	Inferior conchae (turbinates)	2	Thin scroll of bone forming kind of shall along inner surface of sidewall of nasal cavity; lies above roof of mouth
	Vomer	1	Forms lower and posterior part of nasal septum; shaped like ploughshare
Ear bones (6 bones)	Malleus (hammer) Incus (anvil) Stapes (stirrup)	2	Tiny bones referred to as auditory ossicles in middle ear cavity in temporal bones; resemble, respectively, minature hammer, anvil, and stirrup
Hyoid bone		1	U-shaped bone in neck between mandible and upper part of larynx; claims distinction as only bone in body not forming a joint with any other bone; suspended by ligaments from styloid processes of temporal bones
Vertebral column (26 bones)			Not actually a column but a flexible segmented rod shaped like an elongated letter S; forms axis of body; head balanced above, ribs and viscera suspended in front, and lower extremities attached below; encloses spinal cord
	Cervical vertebrae	7	First or upper 7 vertebrae
	Thoracic vertebrae	12	Next 12 vertebrae; 12 pairs of ribs attached to these
	Lumbar vertebrae	5	Next 5 vertebrae
	Sacrum	1	Five separate vertebrae until about 25 years of age; then fused to form 1 wedge-shaped bone
	Coccyx	1	Four or 5 separate vertebrae in child but fused into 1 in adult

Part of Body	Name of Bone	Number	Identification
Sternum and ribs (25 bones)			Sternum, ribs, and thoracic vertebrae together form bony cage known as thorax; ribs attach posteriorly to vertebrae, slant downward anteriorly to attacn to sternum (see description of false ribs below)
	Sternum	1	Breastbone; flat dagger-shaped bone
	True ribs	7 pairs	Upper 7 pairs; fasten to sternum by costal cartilages
	False ribs	5 pairs	False ribs do not attach to sternum directly; upper 3 pairs of false ribs attach by means of costal cartilage of seventh ribs; last 2 pairs do not attach to sternum at all; therefore called "floating"
Upper extremities (including shoulder girdle) (64 bones)	Clavicle	2	Collar bones; shoulder girdle joined to axial skeleton by articulation of clavicles with sternum; scapula does not form joint with axial skeleton
	Scapula	2	Shoulder blades; scapulae and clavicles together comprise shoulder girdle
	Humerus	2	Long bone of upper arm
	Radius	2	Bone of thumb side of forearm
	Ulna	2	Bone of little finger side of forearm; longer than radius
	Carpals (scaphoid, lunate, triquetrum, pisiform, trapezium, trapezoid, capitate, and hamate)	16	Arranged in two rows at proximal end of hand
	Metacarpals	10	Long bones forming framework of palm of hand
	Phalanges	28	Miniature long bones of fingers, 3 in each finger, 2 in each thumb
Lower extremities (62 bones)	Ossa coxae or innominate bones	2	Large hip bones; with sacrum and coccyx, these 3 bones form basin-like palvic cavity; lower extremities attached to axial skeleton by pelvic bones
	Femur	2	Thigh bone; largest strongest bone of body
	Patella	2	Kneecap; largest sesamoid bone of body; embedded in tendon of quadriceps femoris muscle
	Tibia	2	Shin bone
	Fibula	2	Long, slender bone of lateral side of lower leg
	Tarsals (calcaneus, talus, navicular, first, second, and third cuneiforms, cuboid)	14	Bones that form heel and proximal or posterior half of foot
	Metatarsals	10	Long bones of feet
	Phalanges	28	Minature long bones of toes; 2 in each great toe, 3 in other toes
Total		206	

Foldout 1. Type, number, and specific locations of the bones of the body.



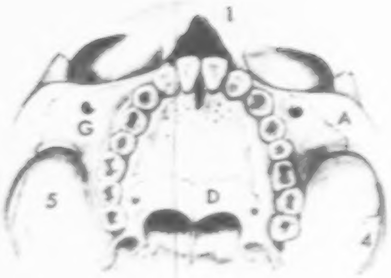
Cranial Bones

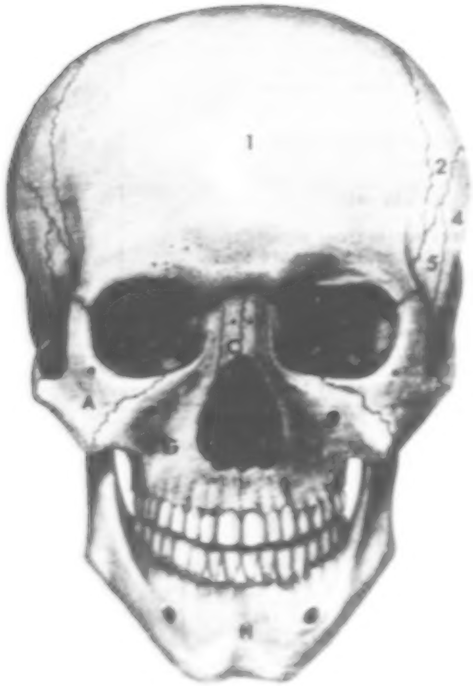
1. Frontal (single)
2. Parietal (paired)
3. Occipital (single)
4. Temporal (paired)
5. Sphenoid (single)
6. Ethmoid (single)

Facial Bones

A. Zygomatic (paired)
B. Lacrimal (paired)
C. Nasal (paired)
D. Palatine (paired)
E. Inferior concha (paired)
F. Vomer (single)
G. Maxilla (paired)
H. Mandible (single)

Foldout 2. Cranial and facial bones of the skull.





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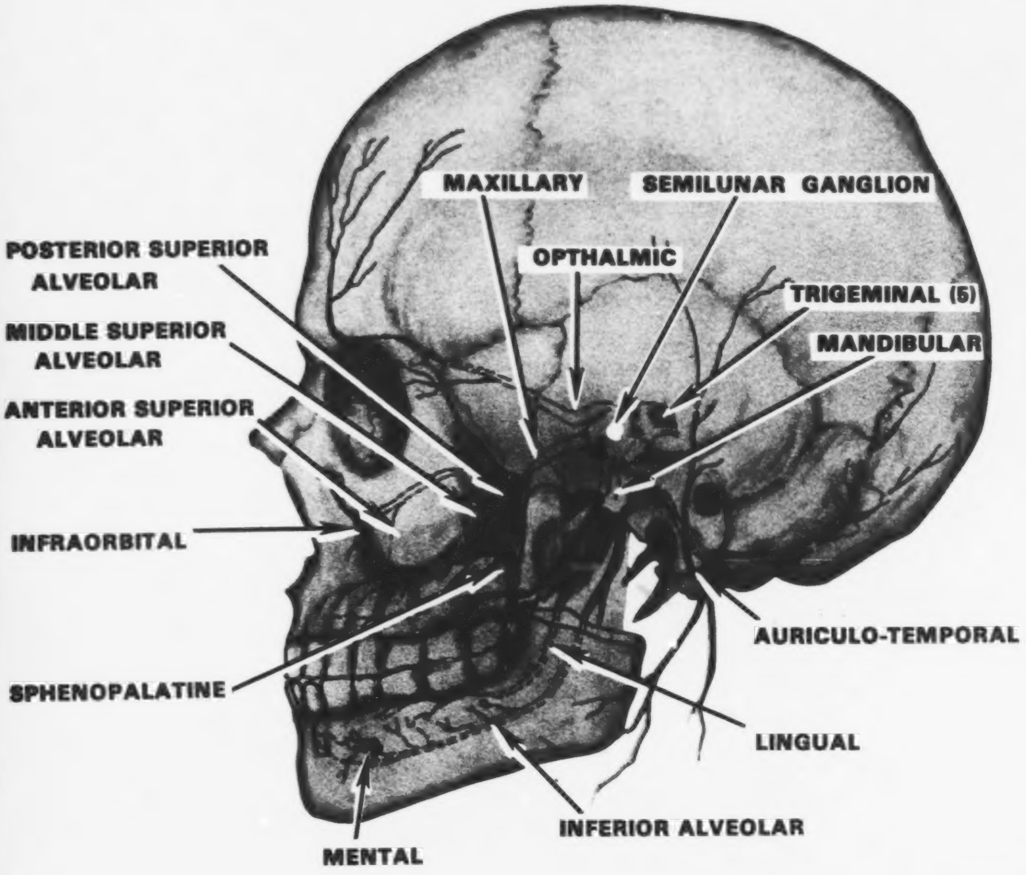
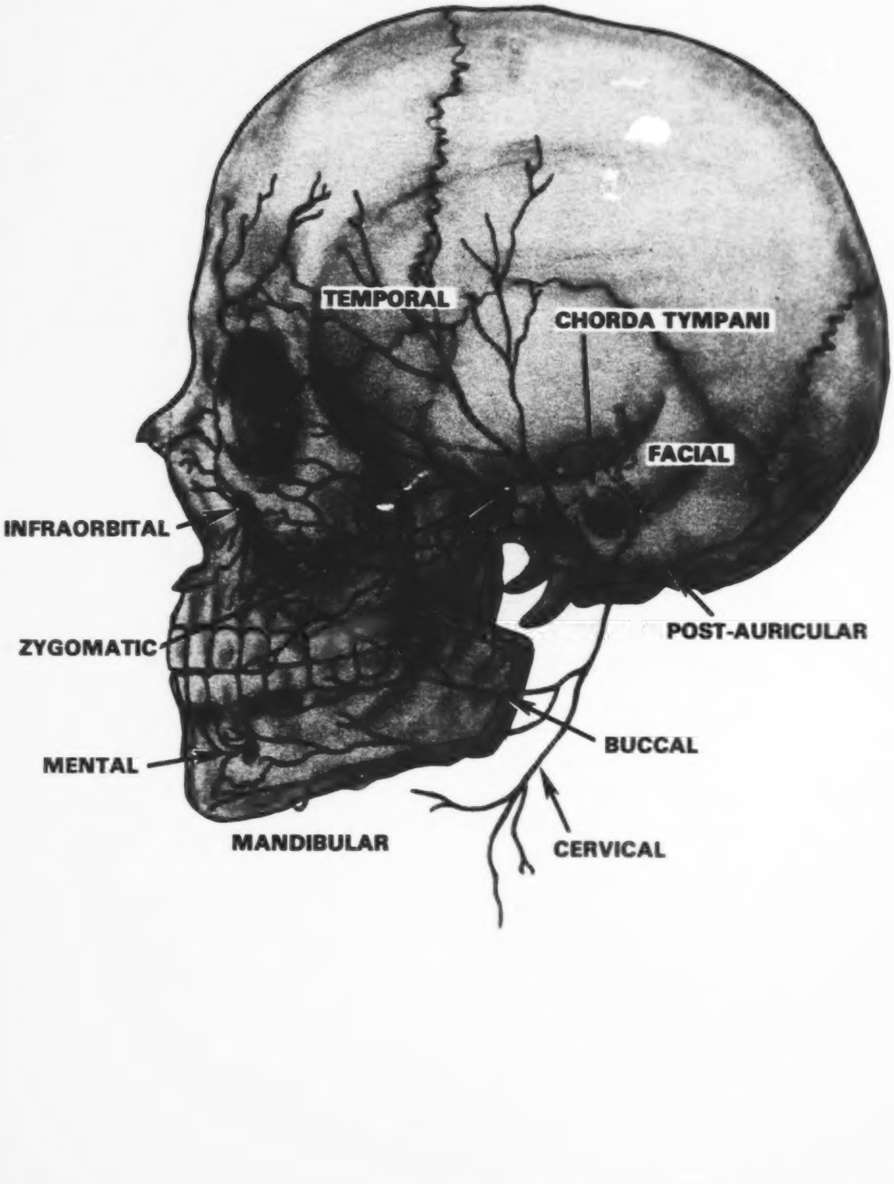
571 A

572

TRIGEMINAL

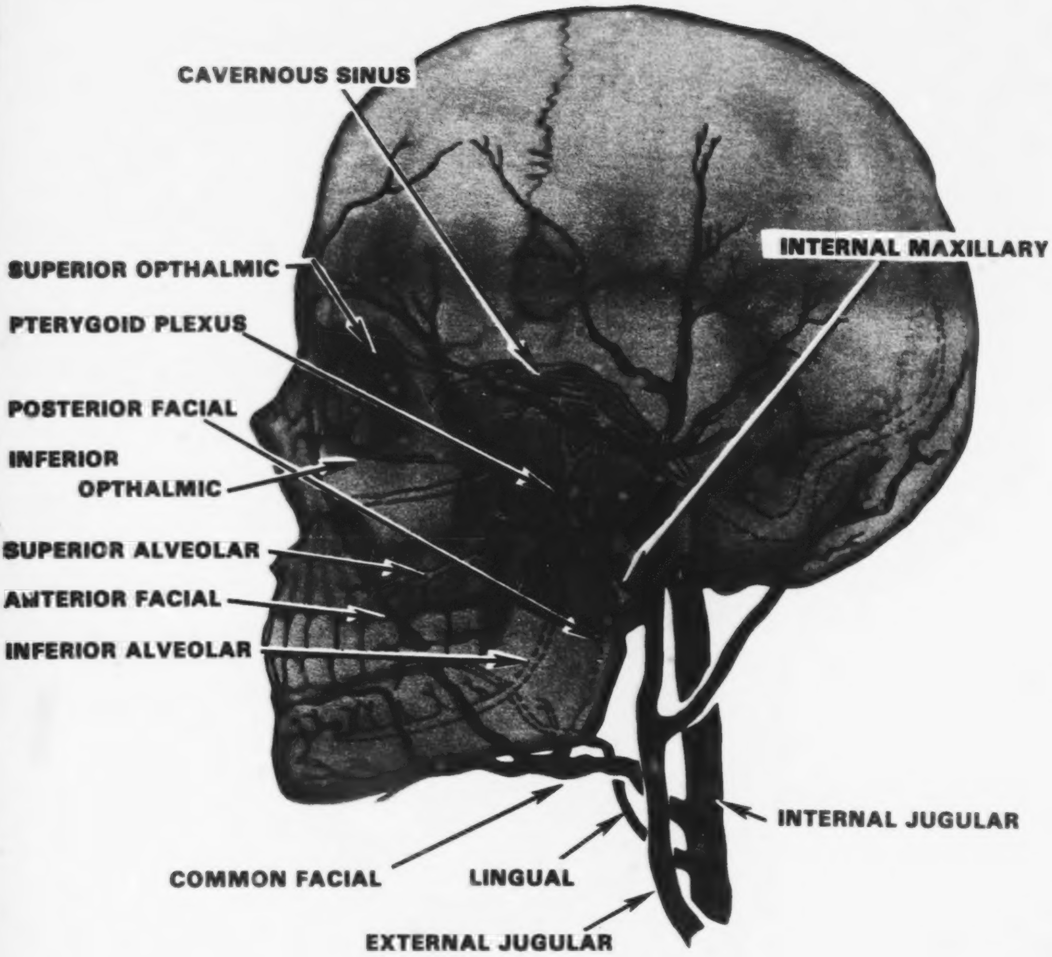

MAXILLARY
SEMILUNAR GANGLION
POSTERIOR SUPERIOR ALVEOLAR
OPTHALMIC
TRIGEMINAL (5)
MIDDLE SUPERIOR ALVEOLAR
MANDIBULAR
ANTERIOR SUPERIOR ALVEOLAR
INFRAORBITAL
AURICULO-TEMPORAL
SPHENOPALATINE
LINGUAL
INFERIOR ALVEOLAR
MENTAL

FACIAL

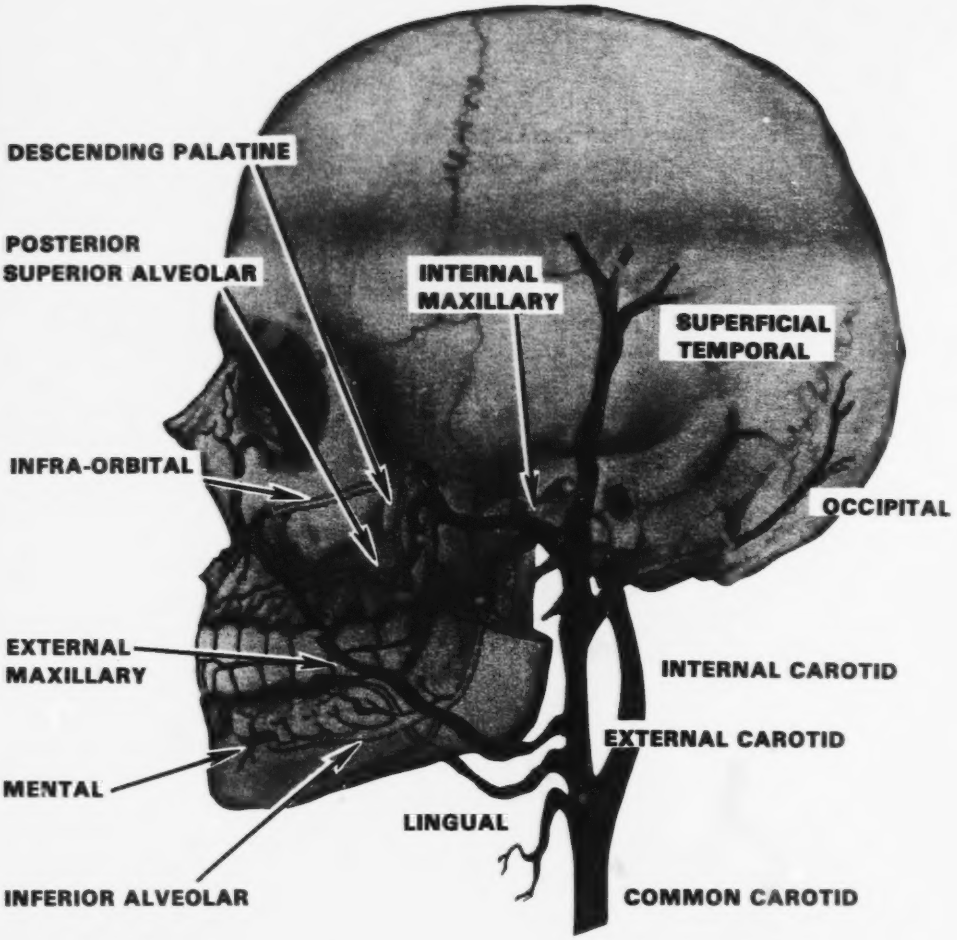

TEMPORAL
CHORDA TYMPANI
FACIAL
INFRAORBITAL
ZYGOMATIC
POST-AURICULAR
BUCCAL
MENTAL
MANDIBULAR
CERVICAL

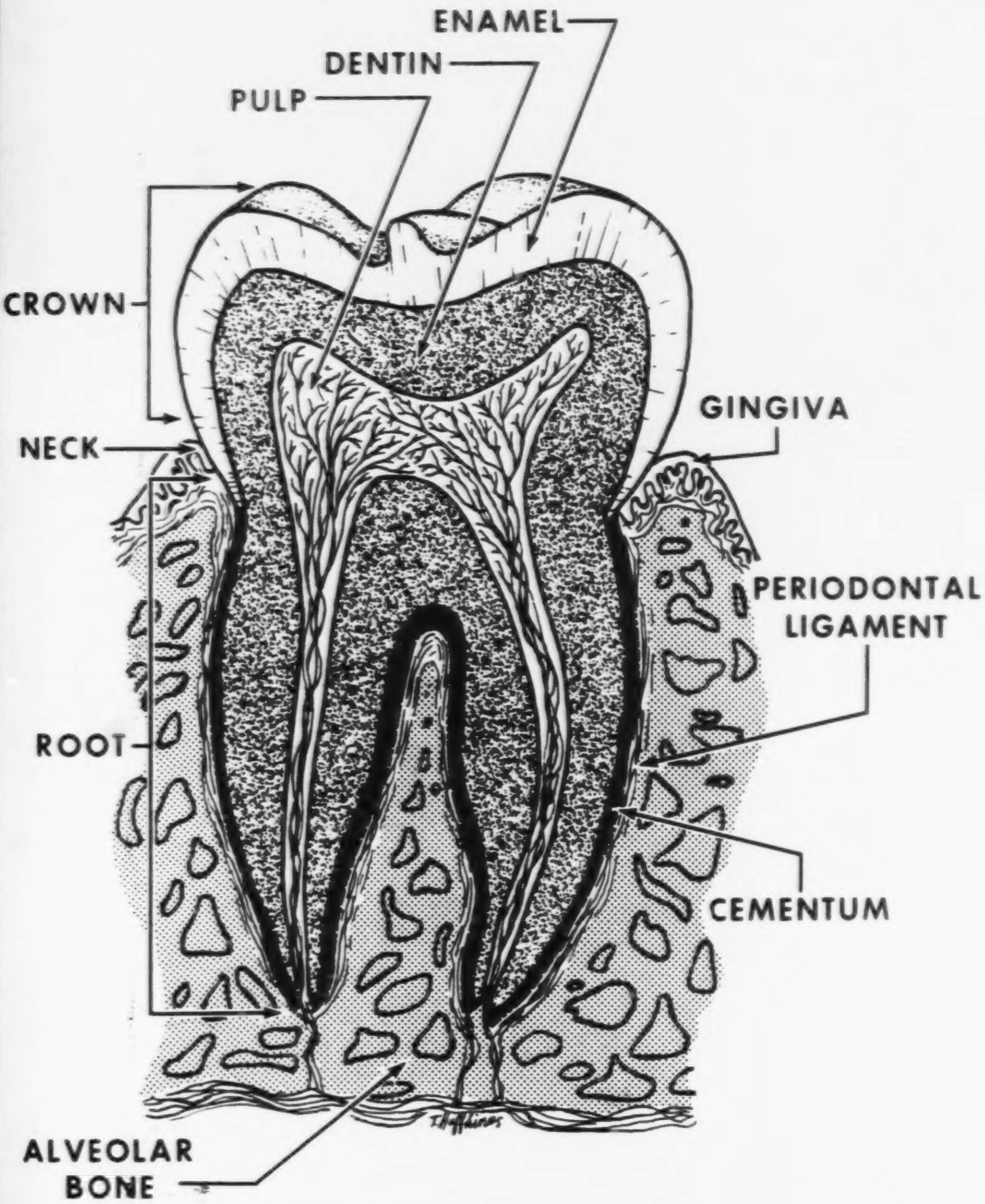
Foldout 4. Arteries and veins of the head.

VEINS


CAVERNOUS SINUS
SUPERIOR OPTHALMIC
PTERYGOID PLEXUS
POSTERIOR FACIAL
INFERIOR OPTHALMIC
SUPERIOR ALVEOLAR
ANTERIOR FACIAL
INFERIOR ALVEOLAR
INTERNAL MAXILLARY
INTERNAL JUGULAR
COMMON FACIAL
LINGUAL
EXTERNAL JUGULAR

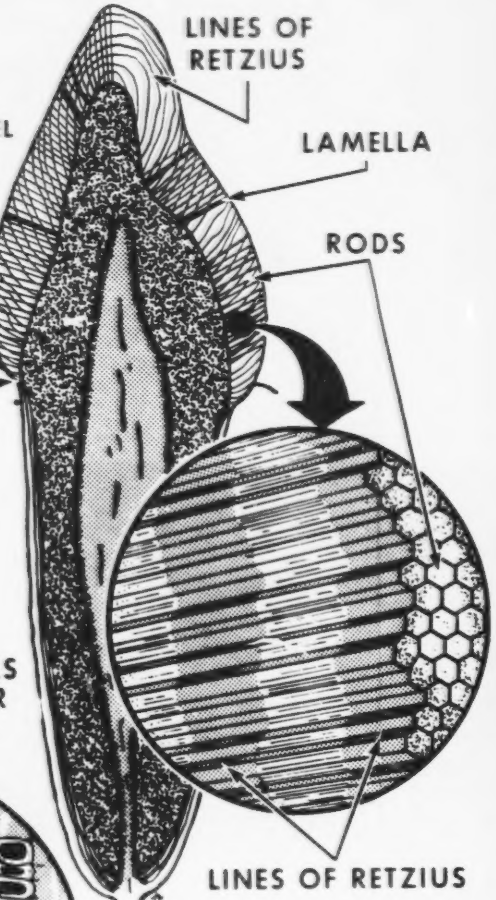
ARTERIES

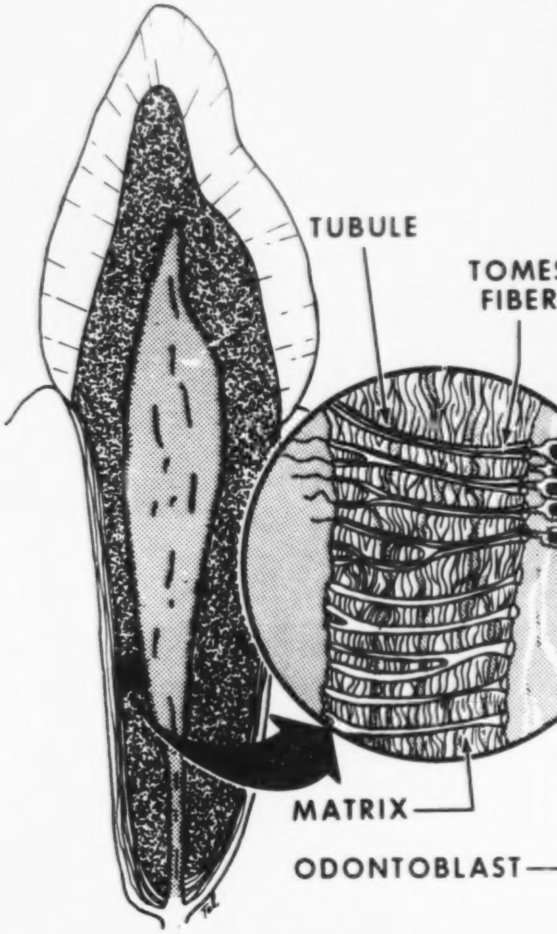

DESCENDING PALATINE
POSTERIOR SUPERIOR ALVEOLAR
INTERNAL MAXILLARY
SUPERFICIAL TEMPORAL
INFRA-ORBITAL
OCCIPITAL
EXTERNAL MAXILLARY
INTERNAL CAROTID
EXTERNAL CAROTID
MENTAL
LINGUAL
INFERIOR ALVEOLAR
COMMON CAROTID


ENAMEL
DENTIN
PULP
CROWN
NECK
GINGIVA
PERIODONTAL LIGAMENT
ROOT
CEMENTUM
ALVEOLAR BONE

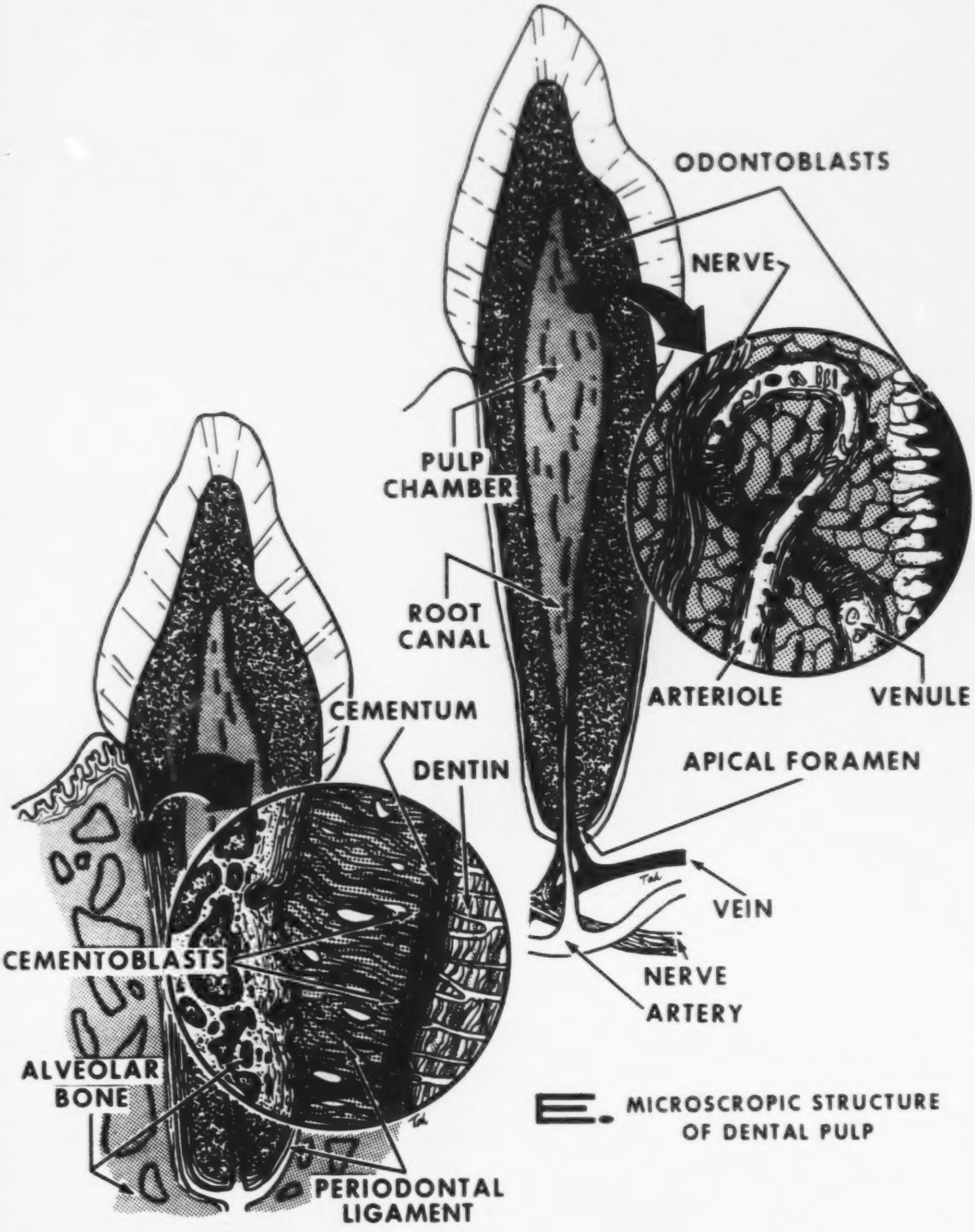
A. CROSS SECTION OF A TOOTH

B. MICROSCROPIC STRUCTURE OF ENAMEL


LINES OF RETZIUS
LAMELLA
RODS
DENTINO-ENAMEL JUNCTION
LINES OF RETZIUS


TUBULE
TOMES FIBER
MATRIX
ODONTOBLAST

C. MICROSCROPIC STRUCTURE OF DENTIN


ODONTOBLASTS
NERVE
PULP CHAMBER
ROOT CANAL
ARTERIOLE
VENULE
APICAL FORAMEN
VEIN
NERVE
ARTERY
CEMENTUM
DENTIN
CEMENTOBLASTS
ALVEOLAR BONE
PERIODONTAL LIGAMENT

E. MICROSCROPIC STRUCTURE OF DENTAL PULP

D. MICROSCROPIC STRUCTURE OF CEMENTUM

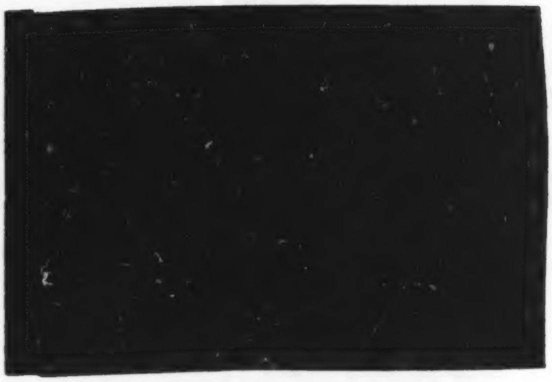
Foldout 5. Anatomical structures of the teeth.

Amalgam Tattoo

Angular Chelosis

Candidosis

Caries



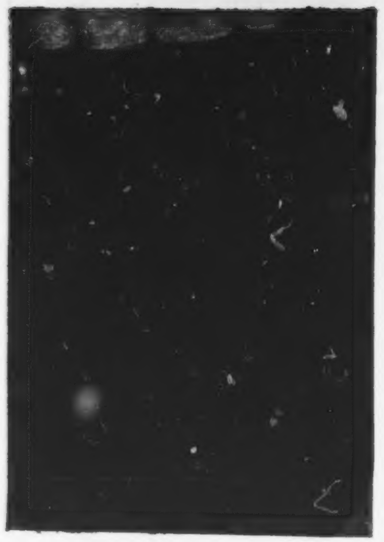
Epulis Fissuratum

Fibroma

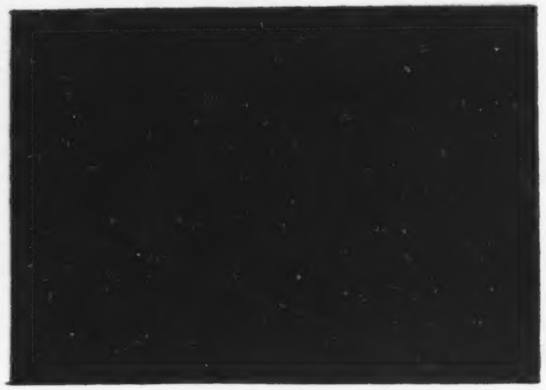
Apthous Stomatitis

Geographic Tongue

Herpes Labialis



Hairy Tongue



Dilantin Hyperplasia

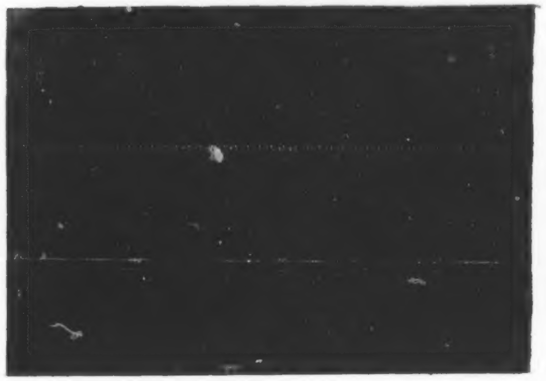
Leukoedema

Leukoplakia

Manibular Tori

Fordyce Granules

Mucocele



Nicotine Stomatitis

NUG

Palate Tori

Papillary Hyperplasia

Papilloma

Pericoronitis

Peripheral Giant Cell Granuloma

Primary Herpetic Stomatitis

Pyogenic Granuloma

Squamous Cell Carcinoma

Foldout 6. Oral pathology.

GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11.806-8—OCTOBER 1975

HEALTH RECORD	DENTAL

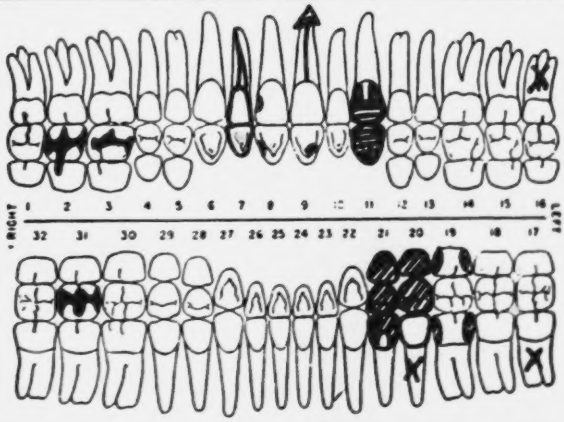
SECTION I. DENTAL EXAMINATION

1. PURPOSE OF EXAMINATION: ☐ INITIAL ☐ SEPARATION X OTHER (*Specify*) No Record Available

2. TYPE OF EXAM.: X 1 ☐ 2 ☐ 3 ☐ 4

3. DENTAL CLASSIFICATION: 1 B 2 ☐ 3 ☐ 4 ☐ 5

4. MISSING TEETH AND EXISTING RESTORATIONS



REMARKS

Teeth #7, 10 in slight labioversion.

Cleft lip, incomplete, left lateral, repaired.

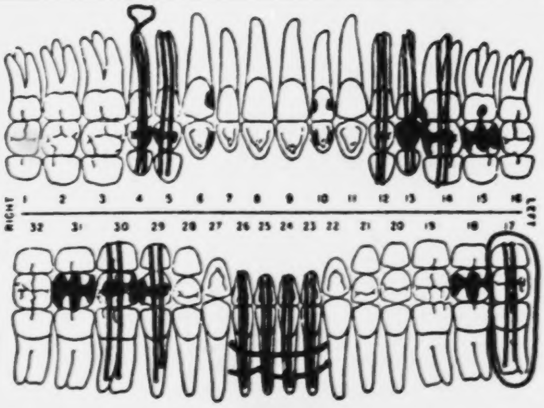
History of mandibular fracture, (1968) midline, healed.

PLACE OF EXAMINATION: ------------AFB, Texas

DATE: 30 Jun 80

SIGNATURE OF DENTIST COMPLETING THIS SECTION: Kenneth W Stoffer, Col, USAF, DC

5. DISEASES, ABNORMALITIES, AND X-RAYS



A. CALCULUS: ☐ SLIGHT ☐ MODERATE X HEAVY

B. PERIODONTOCLASIA: X LOCAL ☐ GENERAL; ☐ INCIPIENT ☐ MODERATE X SEVERE

C. STOMATITIS (*Specify*): X GINGIVITIS ☐ VINCENT'S

D. DENTURES NEEDED (*Include dentures needed after indicated extractions*)

FULL: ☐ U ☐ L
PARTIAL: X U X L

ABNORMALITIES OF OCCLUSION—REMARKS

Tooth #12 rotated 25 degrees mesially.

Def Fix Pr Dtr #19, 20 21.

Car under fil #31.

6. INDICATE X-RAYS USED IN THIS EXAMINATION: X FULL MOUTH PERIAPICAL X POSTERIOR BITE-WINGS ☐ OTHER (*Specify*)

DATE: 30 Jun 80

PLACE OF EXAMINATION: ---------------- AFB, Texas

SIGNATURE OF DENTIST COMPLETING THIS SECTION: Kenneth W Stoffer, Col, USAF, DC

SECTION II. PATIENT DATA

6. SEX	7. RACE	8. GRADE, RATING, OR POSITION	9. ORGANIZATION UNIT	10. COMPONENT OR BRANCH	11. SERVICE, DEPT., OR AGENCY
M	Cau				AF

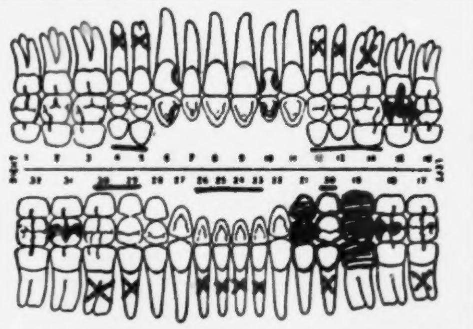
12. PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME	13. DATE OF BIRTH (DAY—MONTH—YEAR)	14. IDENTIFICATION NO.
ELING, DAVID RUSSELL	18 Oct 1948	000-00-0000

NSN 7540-00-634-4179

DENTAL
Standard Form 603
603-102

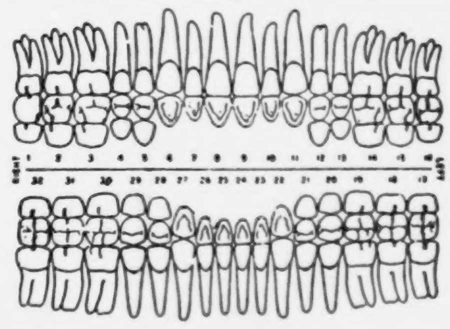
SECTION III. ATTENDANCE RECORD

15. RESTORATIONS AND TREATMENTS (*Completed during service*)



REMARKS

16. SUBSEQUENT DISEASES AND ABNORMALITIES



REMARKS

17. SERVICES RENDERED

DATE	DIAGNOSIS—TREATMENT	CLASS	OPERATOR AND DENTAL FACILITY	INITIALS
30 Jun 80			------- Air Force Base	
	Exam Type 1, Treatment Planning, SF 513			
	to internal medicine (see AF Form 696)	B	K.W. STOFFERS, COL	
10 Jul 80	Cal heavy, periodontal scaling - Pro			
	(complete), CPTSNF, PDC - brushing			
	instructions (BASS)	B	B. SZABO, MSGT	BS
15 Jul 80	Exam Type 3, Pitis #5, 29, 30, Abs			
	Per #4 chronic; Ext Anes Reg, SF 513			
	consultation report from internal medi-			
	cine reviewed (local Anes allergy nega-			
	tive)	B	J.J. MCDONALD, LT COL	JJM
23 Jul 80	Pitis #12, 13, 14, Tooth Imp #17, Ext			
	Anes Reg, 3 sutures	B	J.J. MCDONALD, LT COL	JJM
29 Jul 80	Re Pitis #12, 13, 14, POT, Su Rem	B	J.J. MCDONALD, LT COL	JJM
7 Aug 80	Exam Type 3, Car #6-M, #10-D, #10-M; B			
	(Dycal) resin (Concise)	B	M.T.L. GOODRICH, CAPT	
9 Aug 80	Car #15-MOD, #18 MO, #15F, #31 MOD; B			
	AM Anes Reg	B	M.T.L. GOODRICH, CAPT	
13 Aug 80	Pedoni Severe #23, 24, 25, 26; Ext, Alvy			
	Man Su (4) Anes Reg	B	J.J. MCDONALD, LT COL	JJM
20 Aug 80	Exam Type 3, Pedoni Moderate #18, 19			
	Gtmy, Anes Reg Su Rem (4)	B	R.C. WALKER, LT COL	
24 Aug 80	Re Pedoni, POT Pack Rem	B	R.C. WALKER, LT COL	
10 Jan 81	Exam Type 3, Def Fx Pr Dtr, Man Rem, Car			
	19, 21, Prep Impr, Tem Acr Crns Ins Anes			
	Reg	B	H.H. BIDDLE, COL	HHB
17 Jan 81	Re #19, Full Cr Gold, Re #21, Porc			
	Veneer Cr (Vita C-3); Ins	B	H.H. BIDDLE, COL	HHB
4 Feb 81	Exam Type 3, Impr Max Man, Occlusal			
	Registration	B	J. SECKIVEC, COL	
19 Feb 81	Missing Teeth #4,5,12,13,14,20,23,24,25,			JS
	26,29,30 Rem Pr Dtr Max Man (Ticonium			
	Acr Bioblend 108) Ins, Adj	A	J. SECKIVEC, COL	JS

ELING, DAVID RUSSELL 000-00-0000

PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME

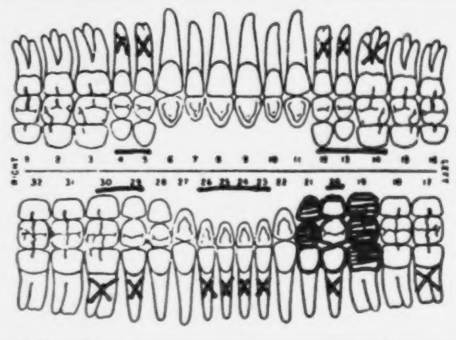
GPO : 1981 O - 341-526 (5638)

Standard Form 603-A

HEALTH RECORD | DENTAL—Continuation

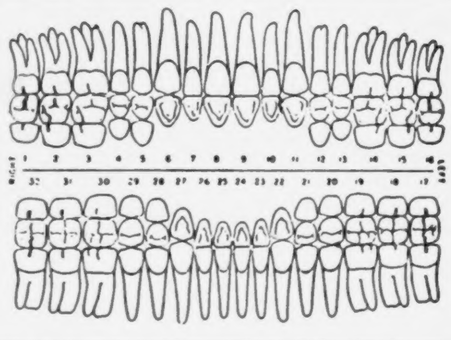
SECTION III. ATTENDANCE RECORD

15. RESTORATIONS AND TREATMENTS (*Completed during service*)



REMARKS

16. SUBSEQUENT DISEASES AND ABNORMALITIES



REMARKS

17. SERVICES RENDERED

DATE	DIAGNOSIS—TREATMENT	CLASS	OPERATOR AND DENTAL FACILITY	INITIALS
14 Mar 82	EXAM Type 2	B	K.W. STOFFERS, COL	
16 Mar 82	Cal light, periodontal scaling-Pro			
	(complete), CPTSNF, PDC-brushing			
	instructions (Bass).	A	G.E. HARRINGTON, TSGT	GEH

ELING, DAVID RUSSELL

PATIENT'S LAST NAME - FIRST NAME - MIDDLE NAME

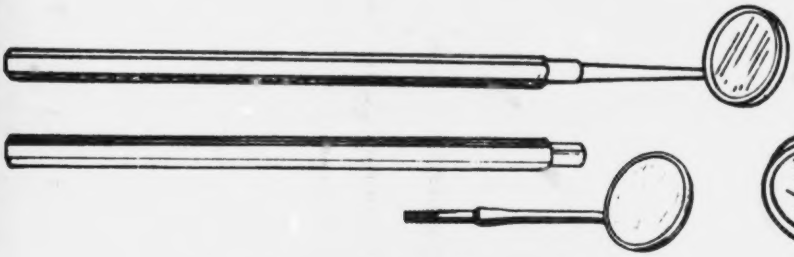
000-00-0000

IDENTIFICATION NO

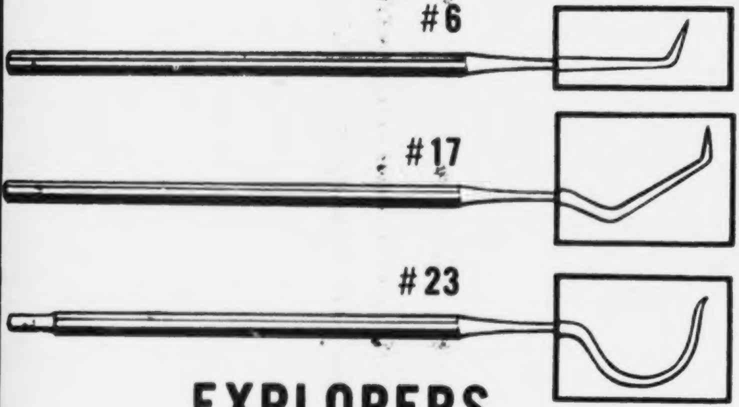
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11.[illegible]
OCTOBER 1975 [illegible]

Foldout 7. SF 603 and SF 603A, Dental Health Records.

58HA



MOUTH MIRRORS



#6

#17

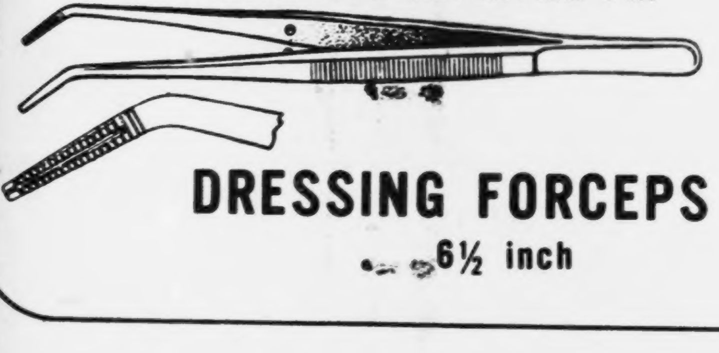
#23

EXPLORERS

MERIAM

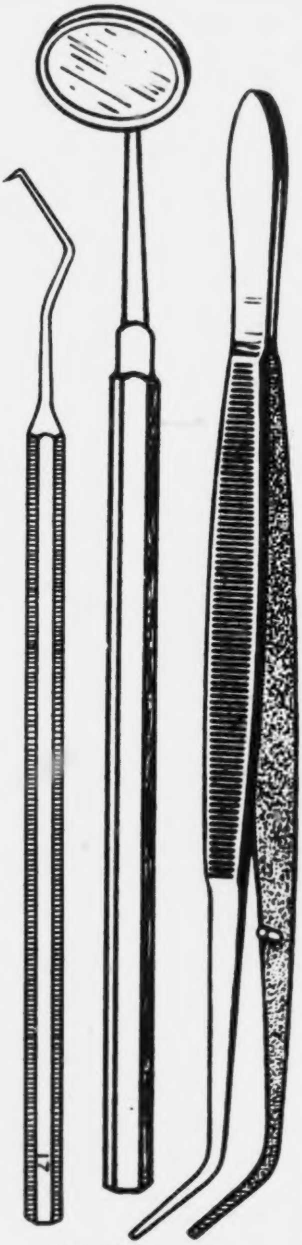
#17

RESTORATIVE RETENTION PIN

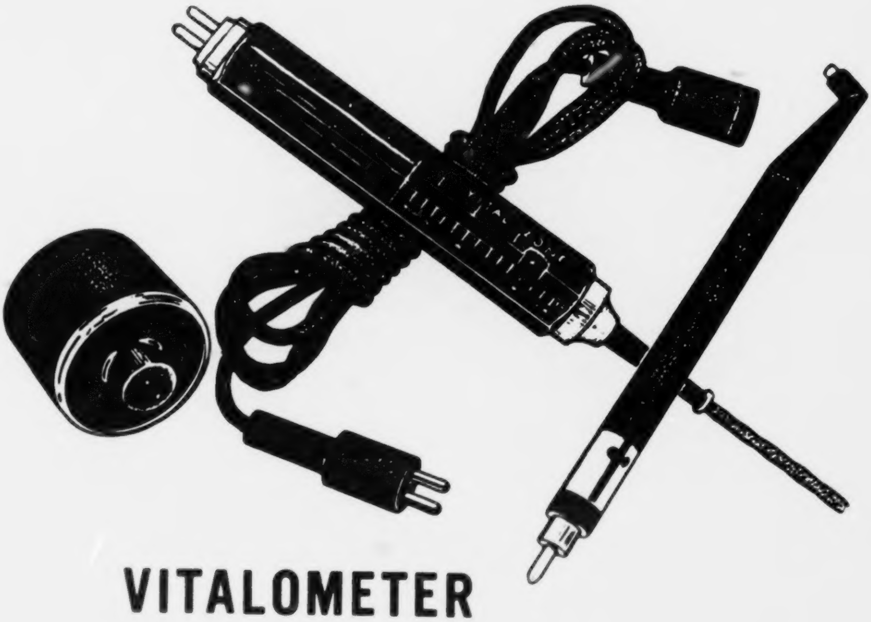


DRESSING FORCEPS

6½ inch

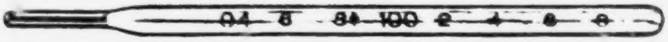


ACTUAL SIZE



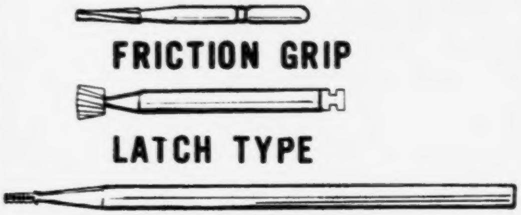
VITALOMETER

586A

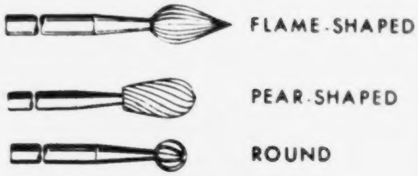

94
6
98
100
2
4
6
8

CLINICAL THERMOMETER

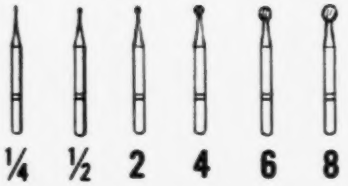
RADIOGRAPH


FRICTION GRIP
LATCH TYPE
STRAIGHT HANDPIECE

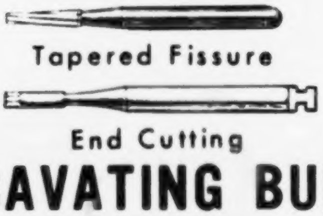
SHAPES & LENGTHS OF BURS


FLAME-SHAPED
PEAR-SHAPED
ROUND

DENTURE TRIMMING BURS

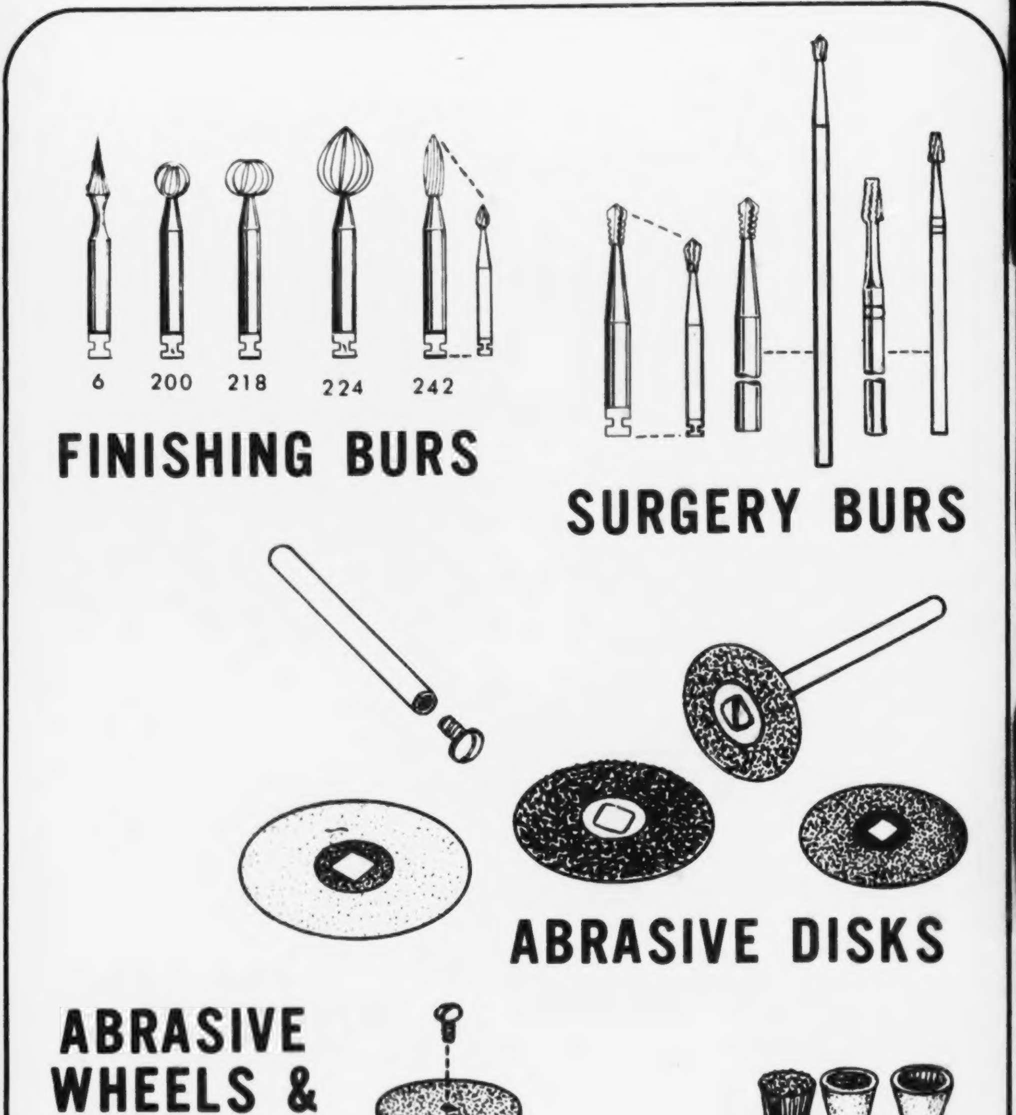


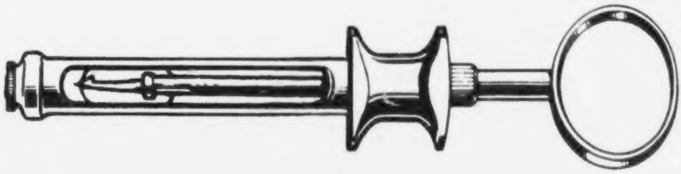
BUR SIZES

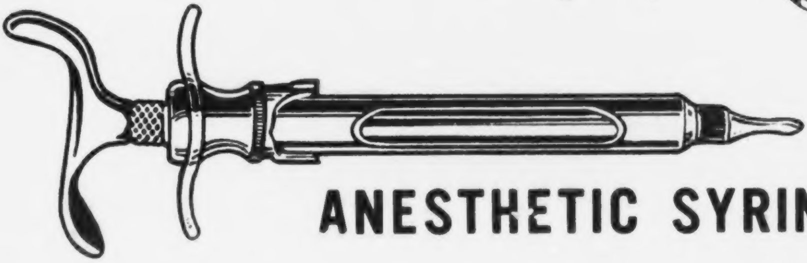

Round
Inverted Cone
Straight Fissure
Tapered Fissure
End Cutting

EXCAVATING BUR DESIGNS

Foldout 8. Diagnostic aids.

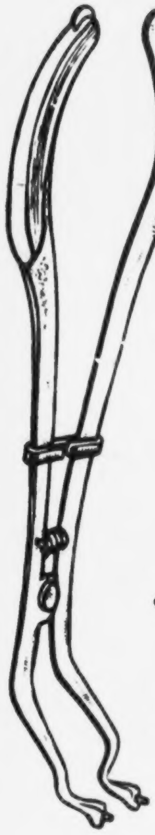

6
200
218
224
242
FINISHING BURS
SURGERY BURS
ABRASIVE DISKS
ABRASIVE WHEELS & POINTS
POLISHING INSTRUMENTS



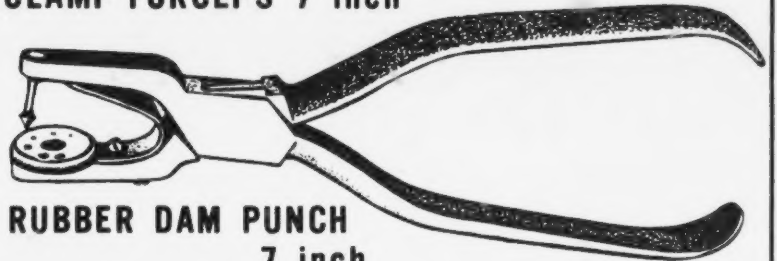


ANESTHETIC SYRINGE

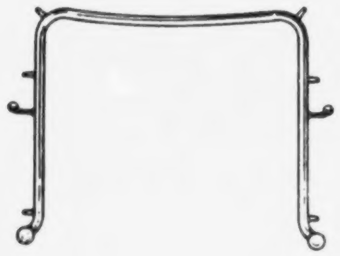
RUBBER DAM EQUIPMENT

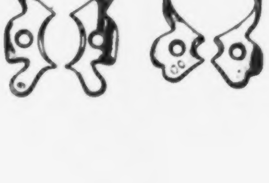


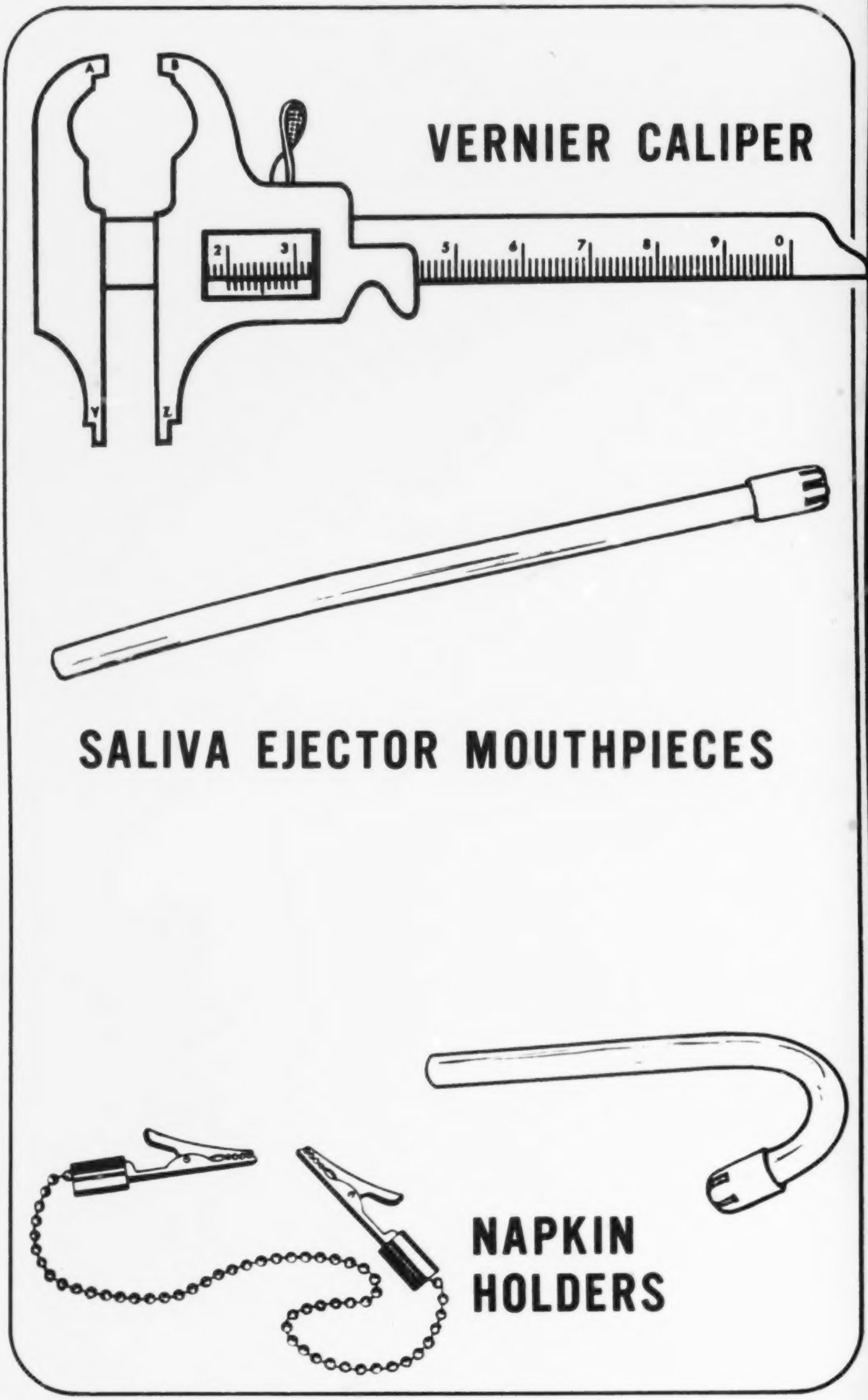
CLAMP FORCEPS 7 inch



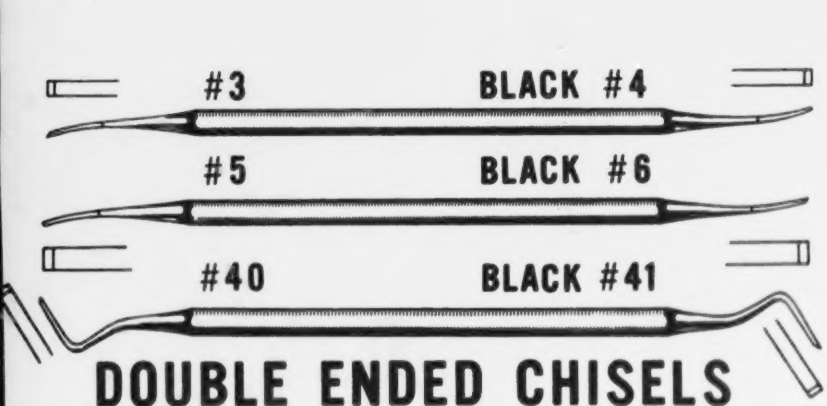
RUBBER DAM PUNCH
7 inch



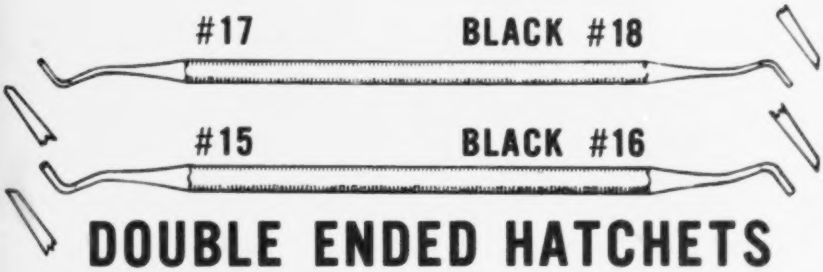



VERNIER CALIPER
A
B
Y
Z
2
3
5
6
7
8
9
0
SALIVA EJECTOR MOUTHPIECES
NAPKIN HOLDERS

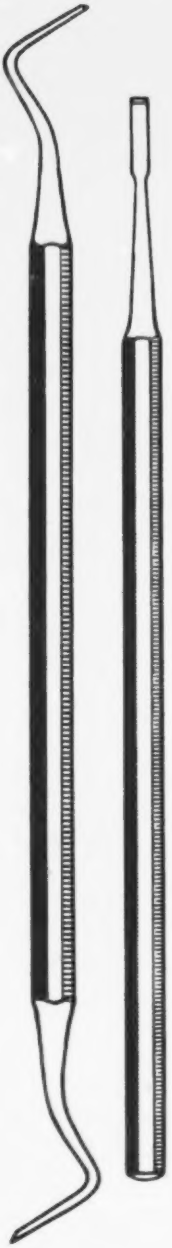
Foldout 9. Dental burs, syringes, and rubber dam equipment.


#3
BLACK #4
#5
BLACK #6
#40
BLACK #41

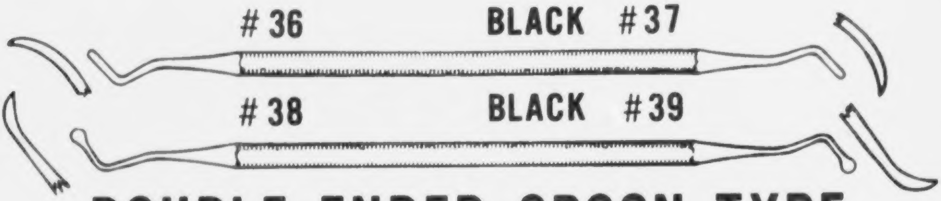
DOUBLE ENDED CHISELS


#17
BLACK #18
#15
BLACK #16

DOUBLE ENDED HATCHETS



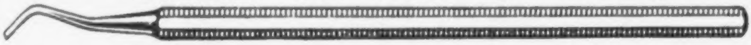
ACTUAL SIZE



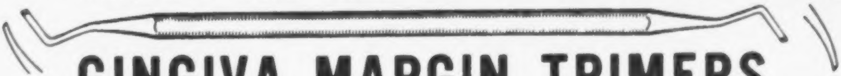
# 36
BLACK #37
# 38
BLACK #39

DOUBLE ENDED SPOON TYPE

BLACK'S #77 THRU 80 4–single end designs



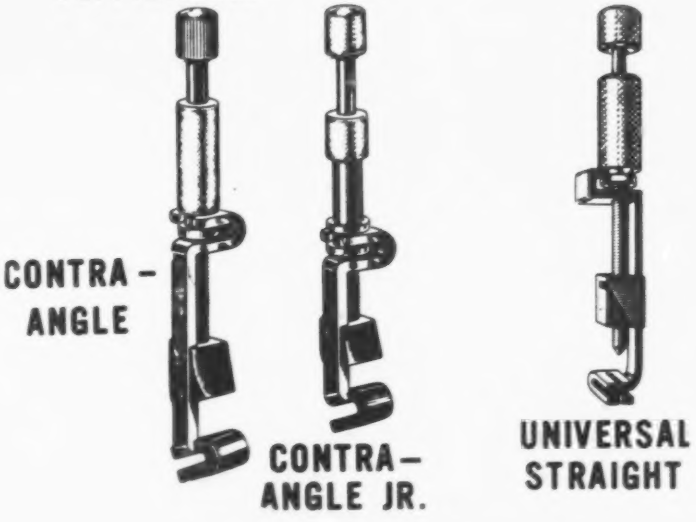
BLACK'S #26 THRU 29 4–double end designs



GINGIVA MARGIN TRIMERS

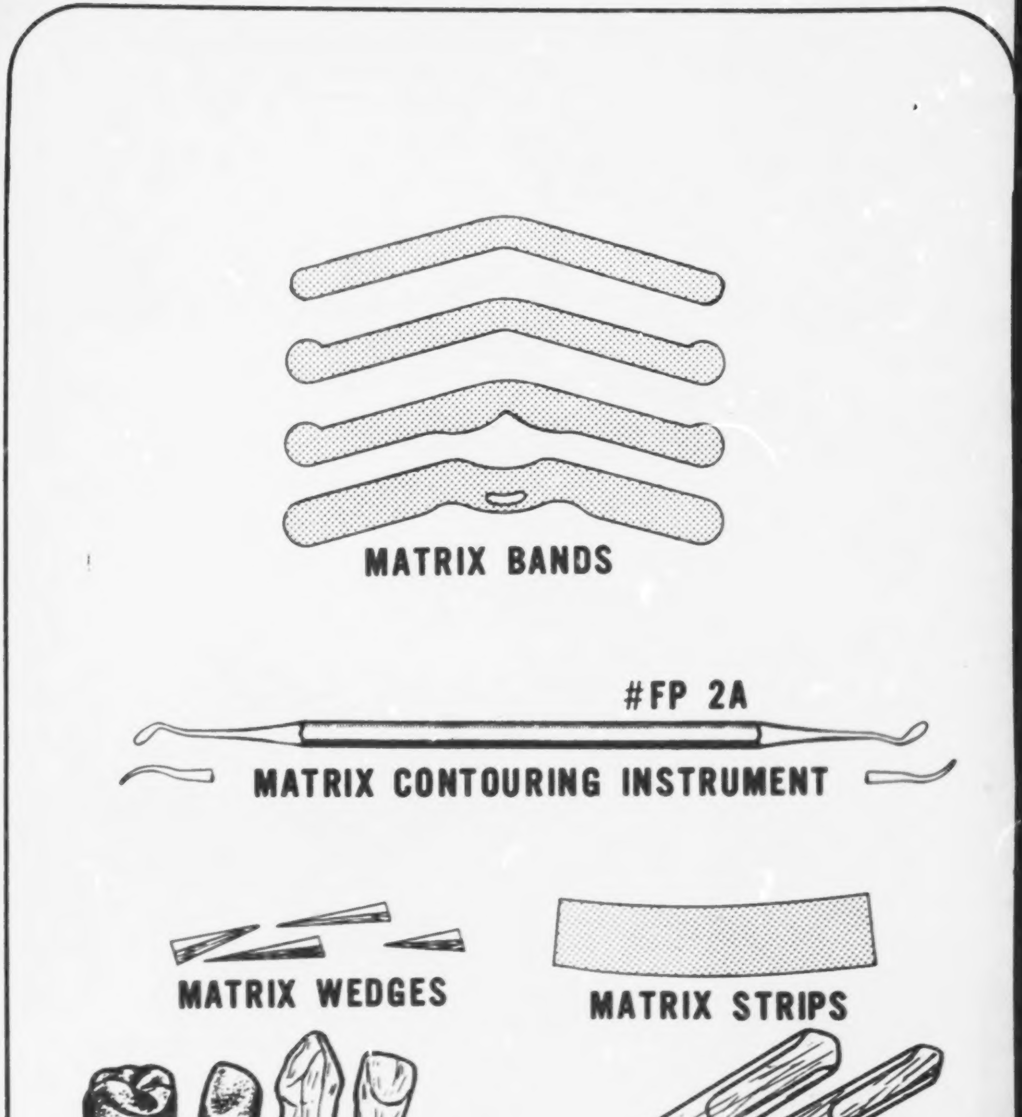
DENTAL MATRICES

TOFFILEMIRE:

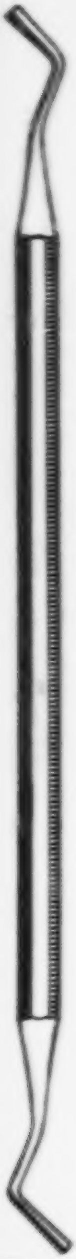


CONTRA-ANGLE
CONTRA-ANGLE JR.
UNIVERSAL STRAIGHT

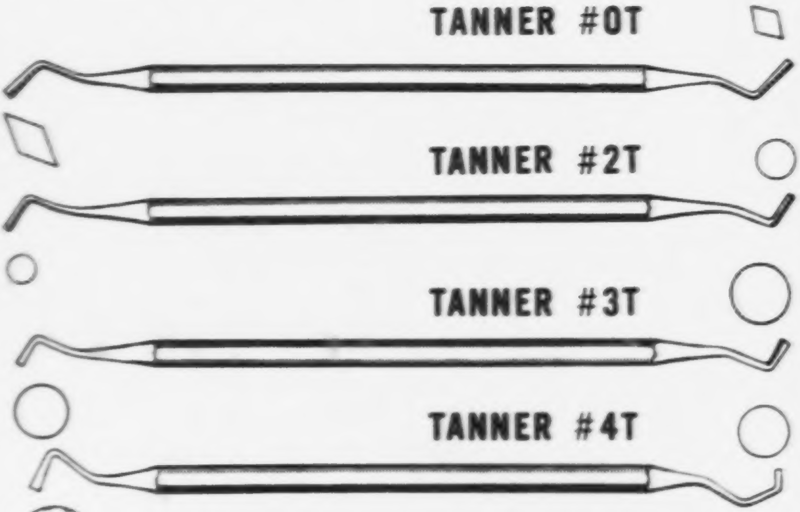
590A

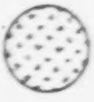

MATRIX BANDS
#FP 2A
MATRIX CONTOURING INSTRUMENT
MATRIX WEDGES
MATRIX STRIPS
MATRIX CROWNS
CERVICAL MATRICES
AMALGAM INSTRUMENTS
CARRIER ACTUAL SIZE

Foldout 10. Cutting instruments, dental matrices.



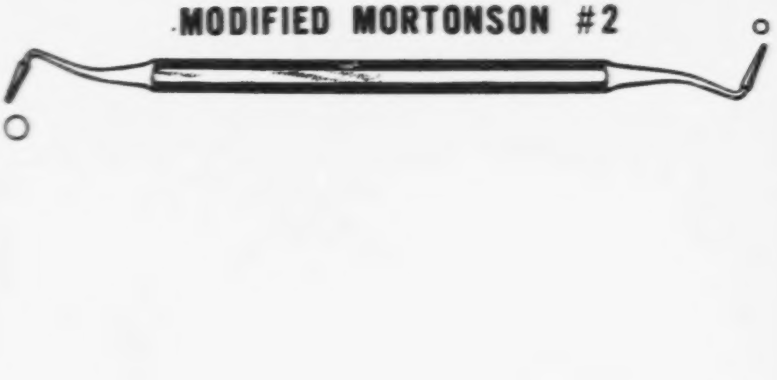
ACTUAL SIZE


TANNER #0T
TANNER #2T
TANNER #3T
TANNER #4T

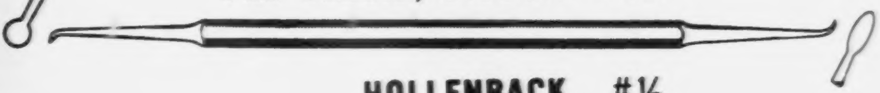


TANNER CONDENSERS

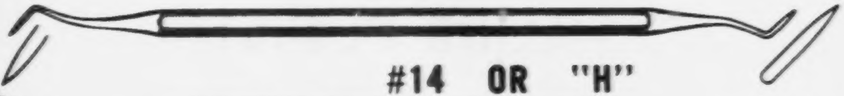
MODIFIED MORTONSON #2



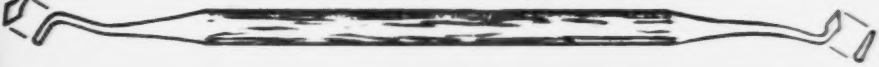
#89 CLEOID, DISCOID #92



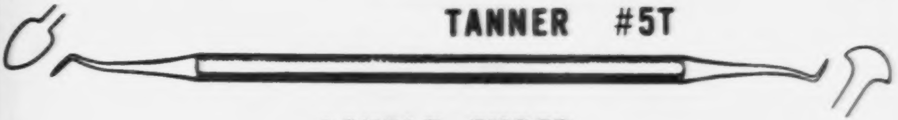
HOLLENBACK #½



#14 OR "H"

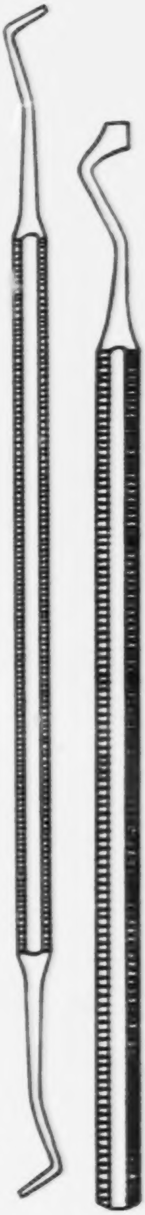


TANNER #5T

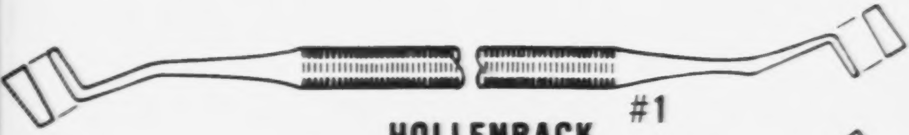


DOUBLE-ENDED

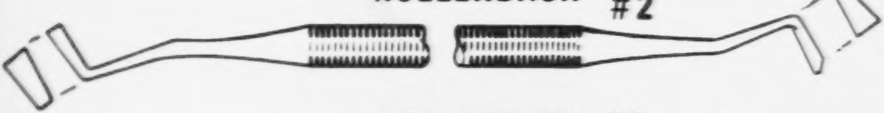
AMALGAM CARVERS



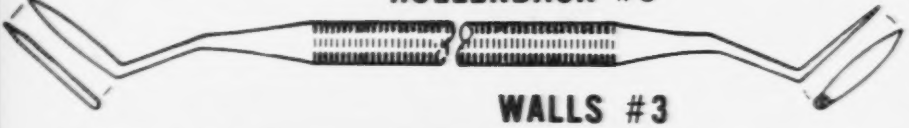
ACTUAL SIZE



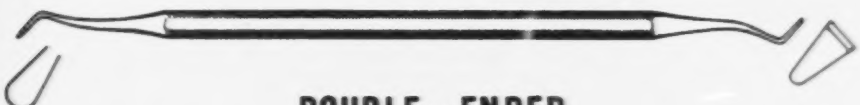
HOLLENBACK #1 #2



HOLLENBACK #3



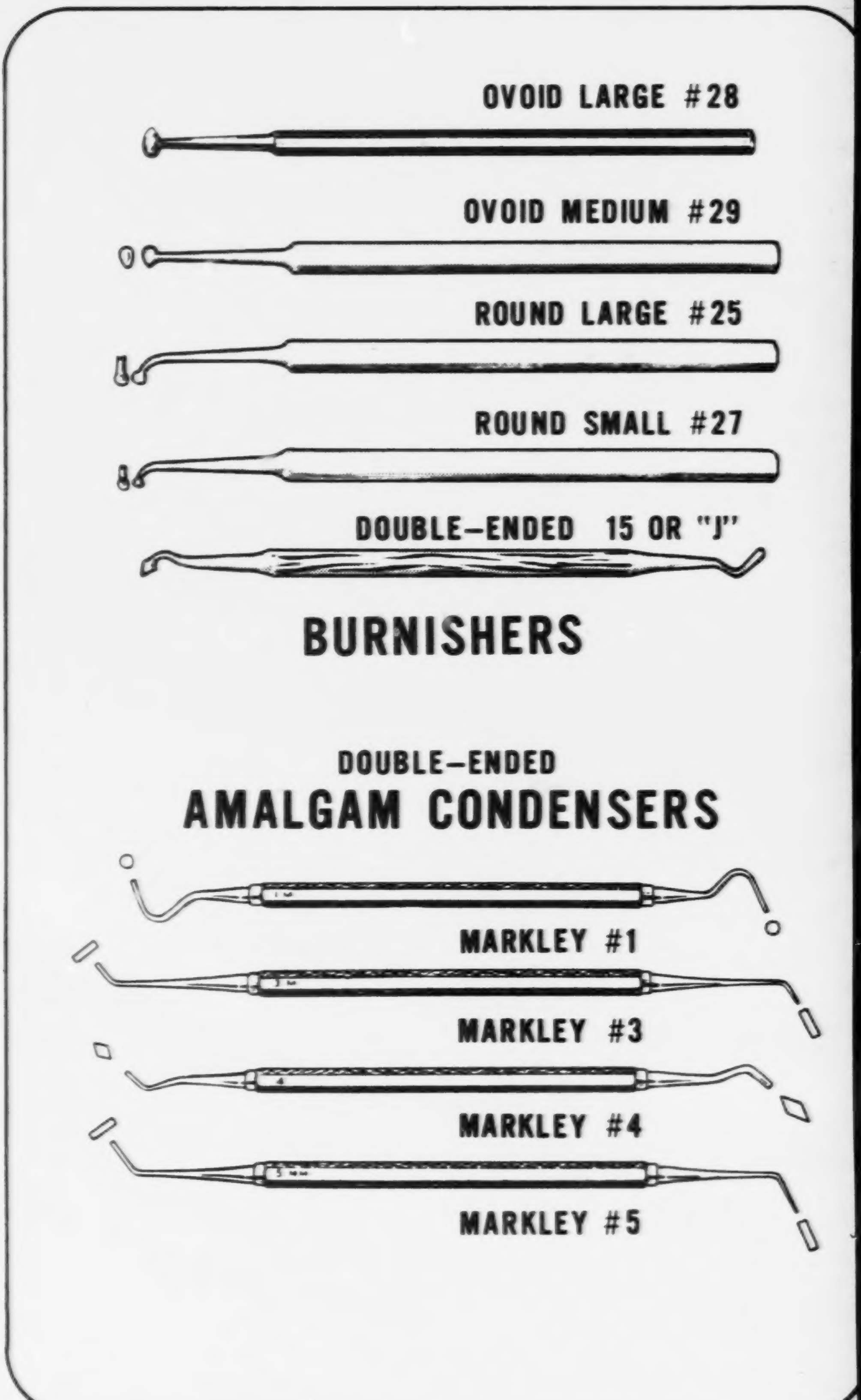
WALLS #3



DOUBLE-ENDED

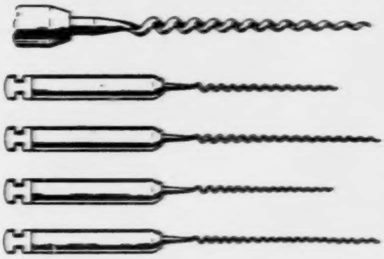
AMALGAM & WAX CARVERS

592A

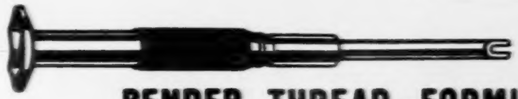

OVOID LARGE #28
OVOID MEDIUM #29
ROUND LARGE #25
ROUND SMALL #27
DOUBLE-ENDED 15 OR "J"
BURNISHERS
DOUBLE-ENDED
AMALGAM CONDENSERS
MARKLEY #1
MARKLEY #3
MARKLEY #4
MARKLEY #5

Foldout 11. Amalgam instruments.

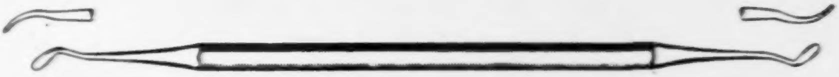
PIN AMALGAM EQUIPMENT



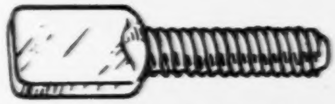
APPLICATOR SET
PIN RETENTION



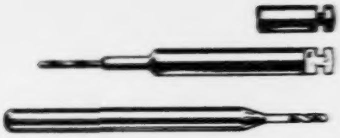
BENDER THREAD-FORMING PIN 2 inch



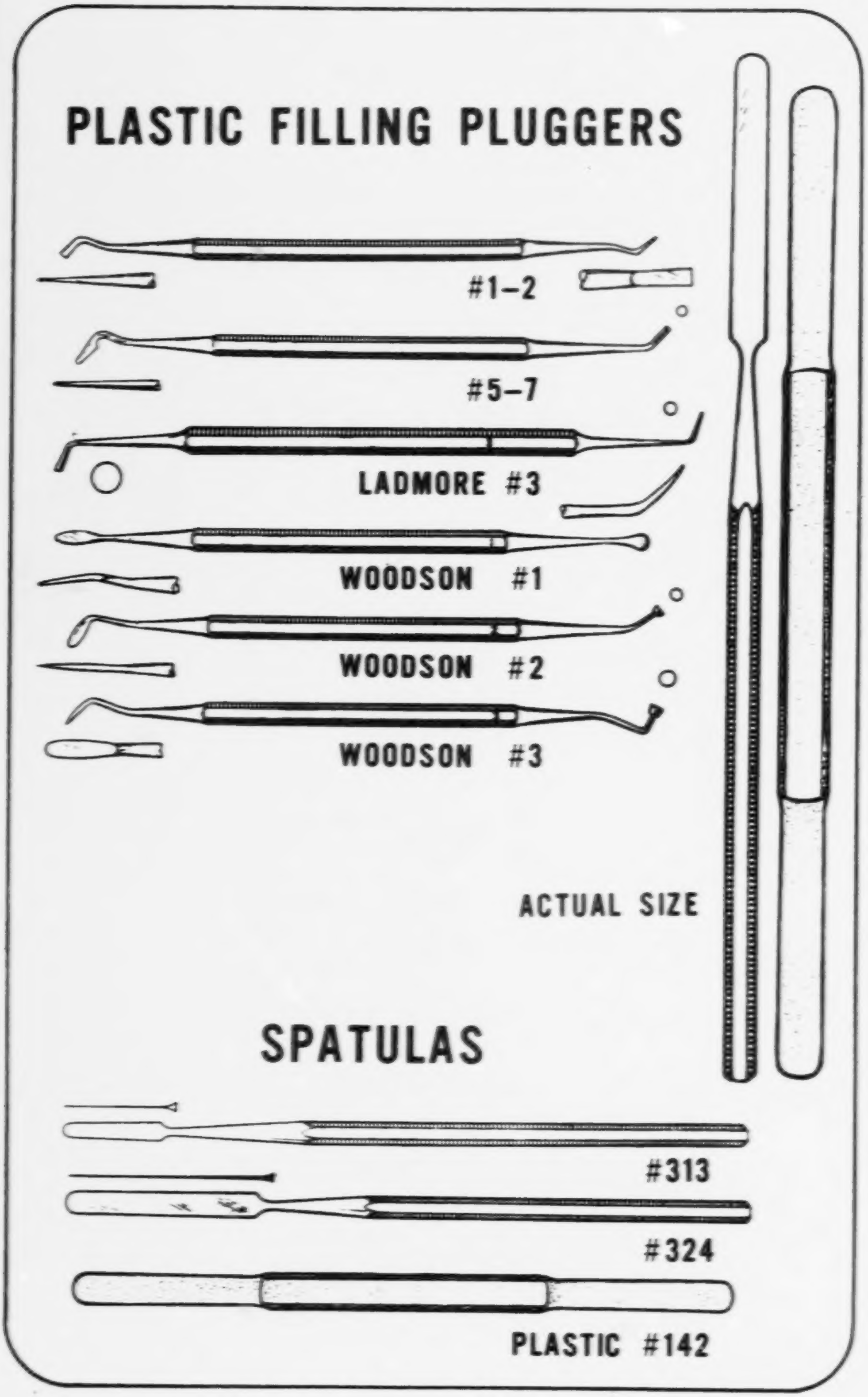
MATRIX CONTOURING INSTRUMENT



THREAD-FORMING PIN
ENLARGED

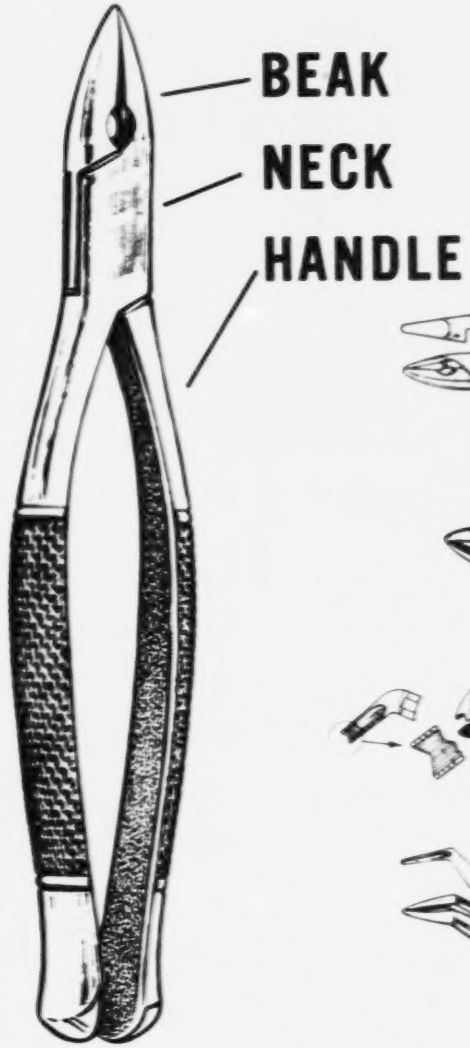


PIN HOLE DRILL


PLASTIC FILLING PLUGGERS
#1–2
#5–7
LADMORE #3
WOODSON #1
WOODSON #2
WOODSON #3
ACTUAL SIZE
SPATULAS
#313
#324
PLASTIC #142

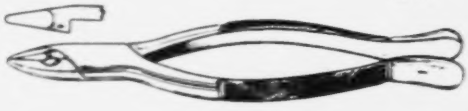
Foldout 12. Pen amalgam set and resin and cement instruments.

EXTRACTION FORCEPS

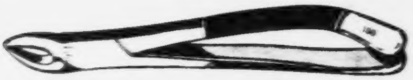

BEAK
NECK
HANDLE

6½ to 7¼ inches
ACTUAL SIZE

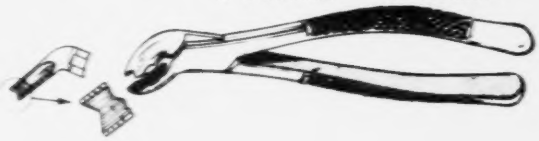
#1



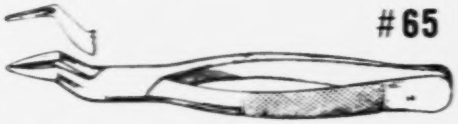
#150 #150S



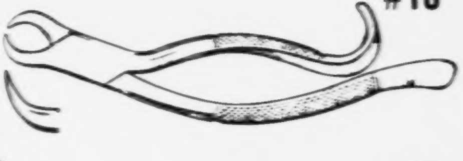
#150AS #151AS



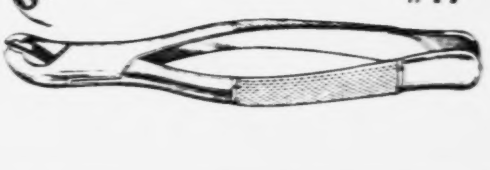
#65



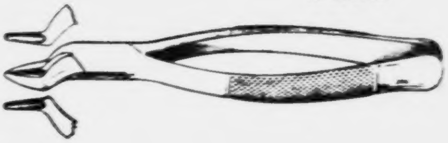
#16



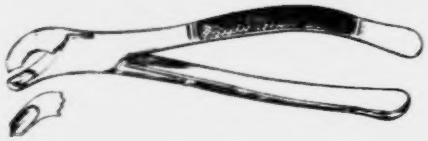
#17



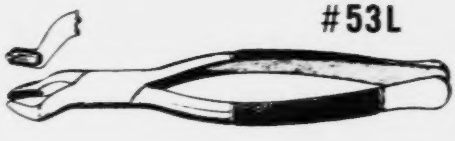
#286



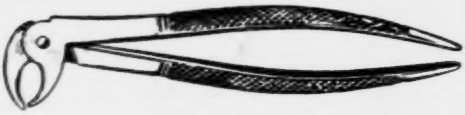
#217



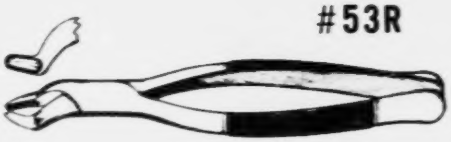
#53L



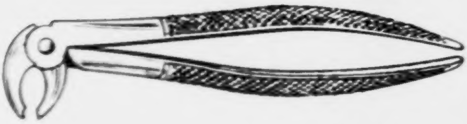
#MD3



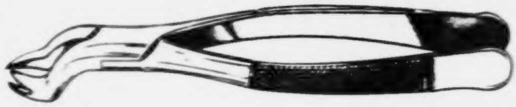
#53R



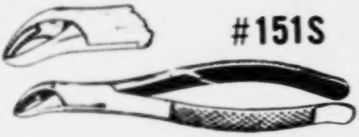
#13 #22



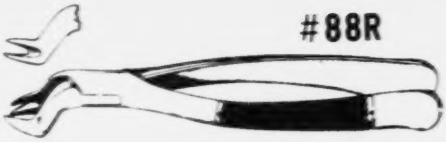
#88L



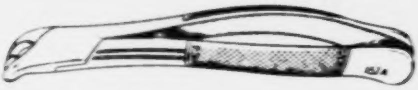
#151
#151S



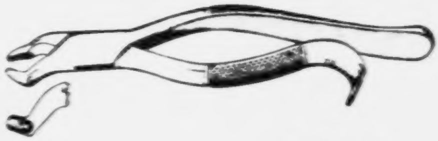
#88R



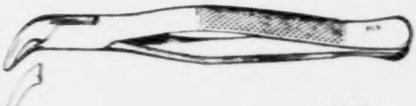
#151A



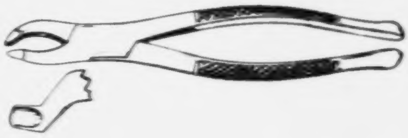
#210



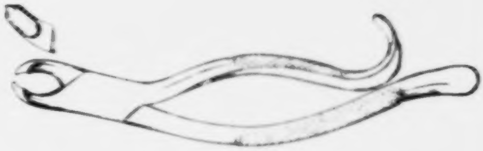
#203



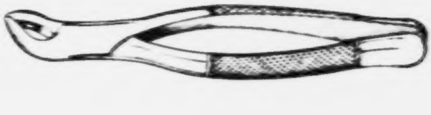
#210S



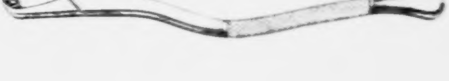
#15



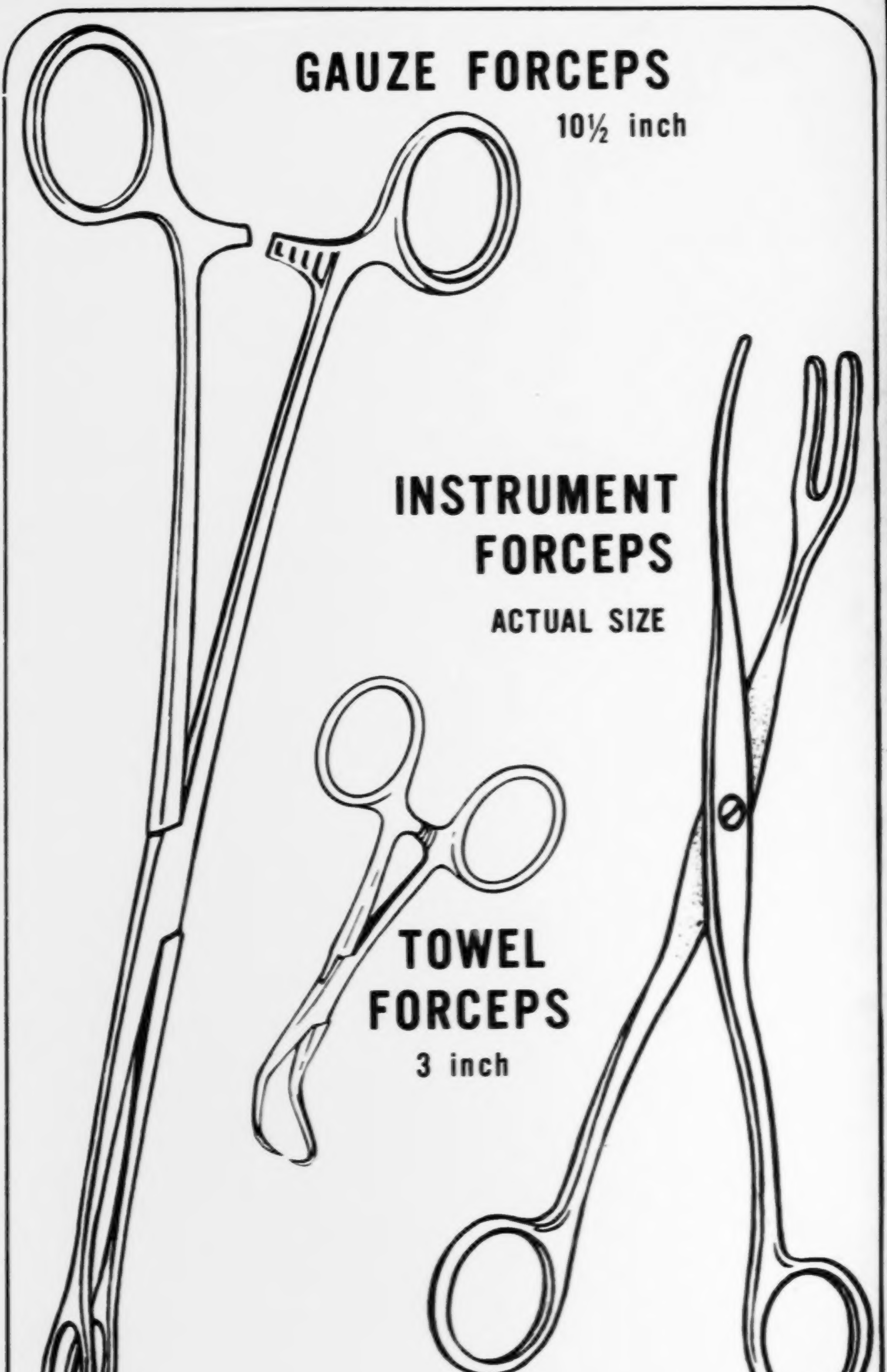
#101



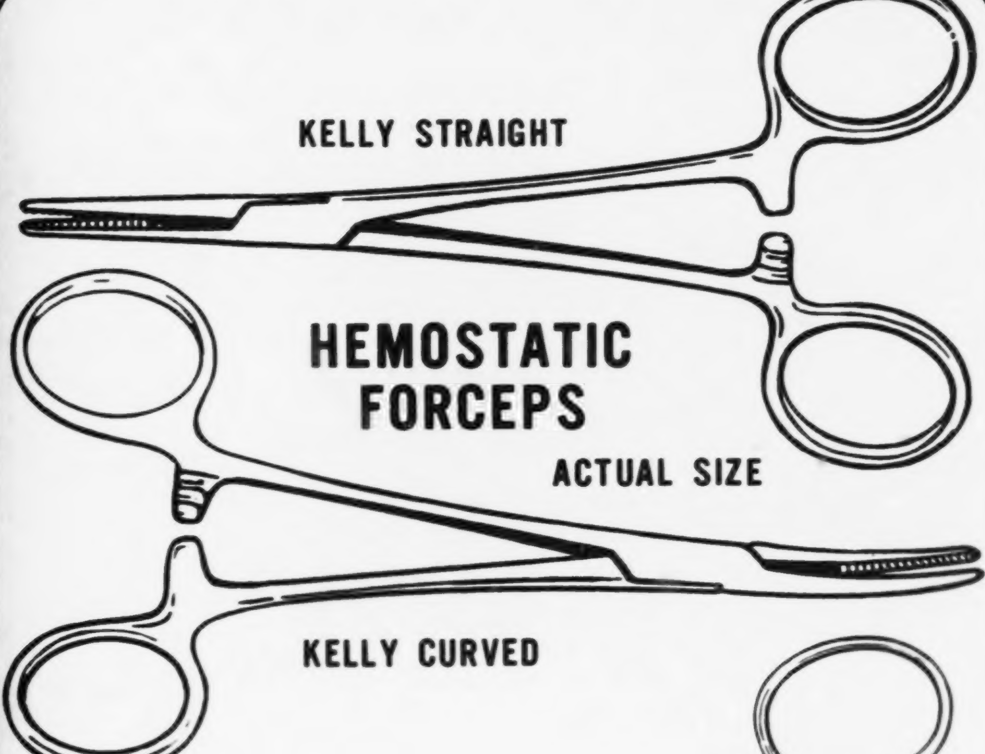
#222



596A

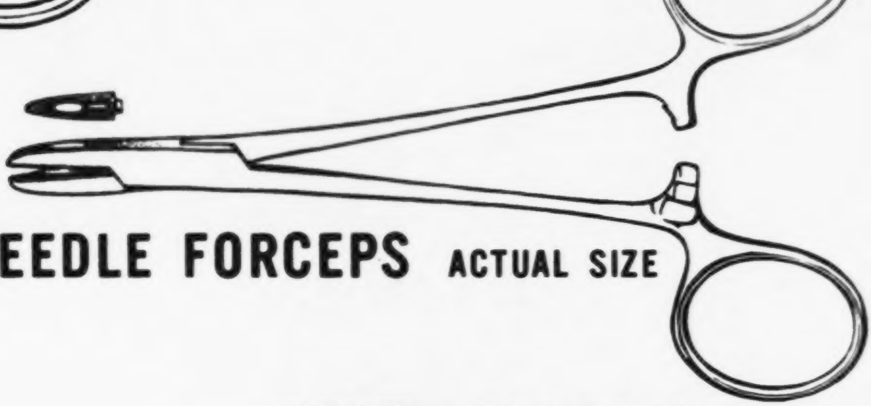

GAUZE FORCEPS
10½ inch
INSTRUMENT FORCEPS
ACTUAL SIZE
TOWEL FORCEPS
3 inch

Foldout 13. Surgical instruments.


KELLY STRAIGHT
KELLY CURVED

HEMOSTATIC FORCEPS

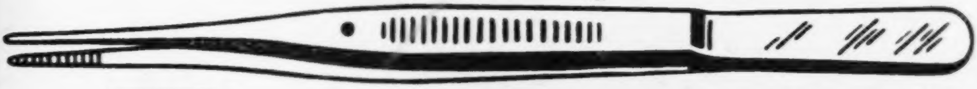
ACTUAL SIZE



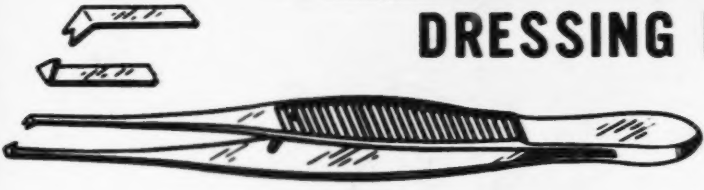
NEEDLE FORCEPS

ACTUAL SIZE

STRAIGHT 5½ & 7 inch



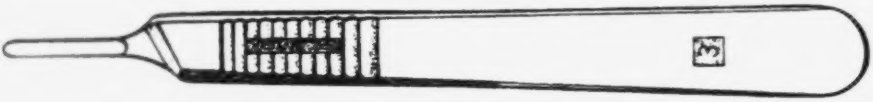
DRESSING FORCEPS



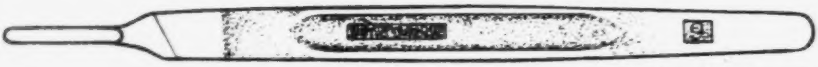
ACTUAL SIZE

TISSUE FORCEPS

#3

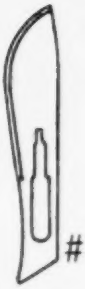


#9

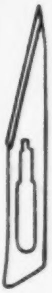


ACTUAL SIZES

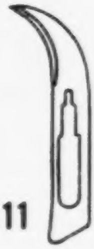
SURGICAL KNIVES & BLADES



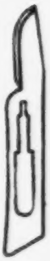
#10



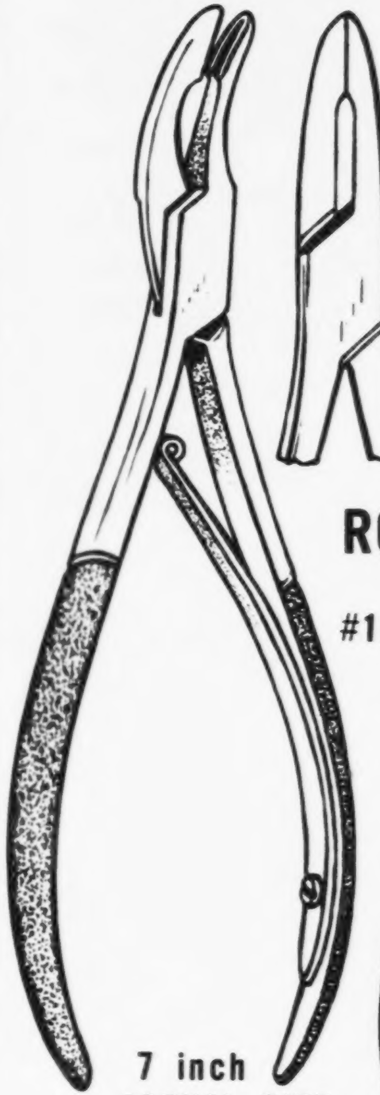
#11



#12



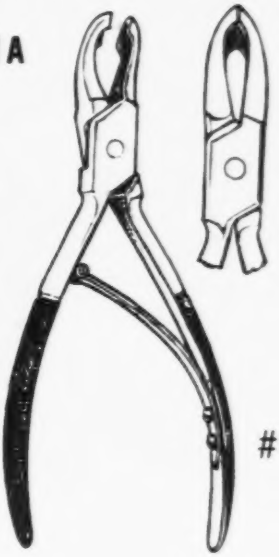
#15



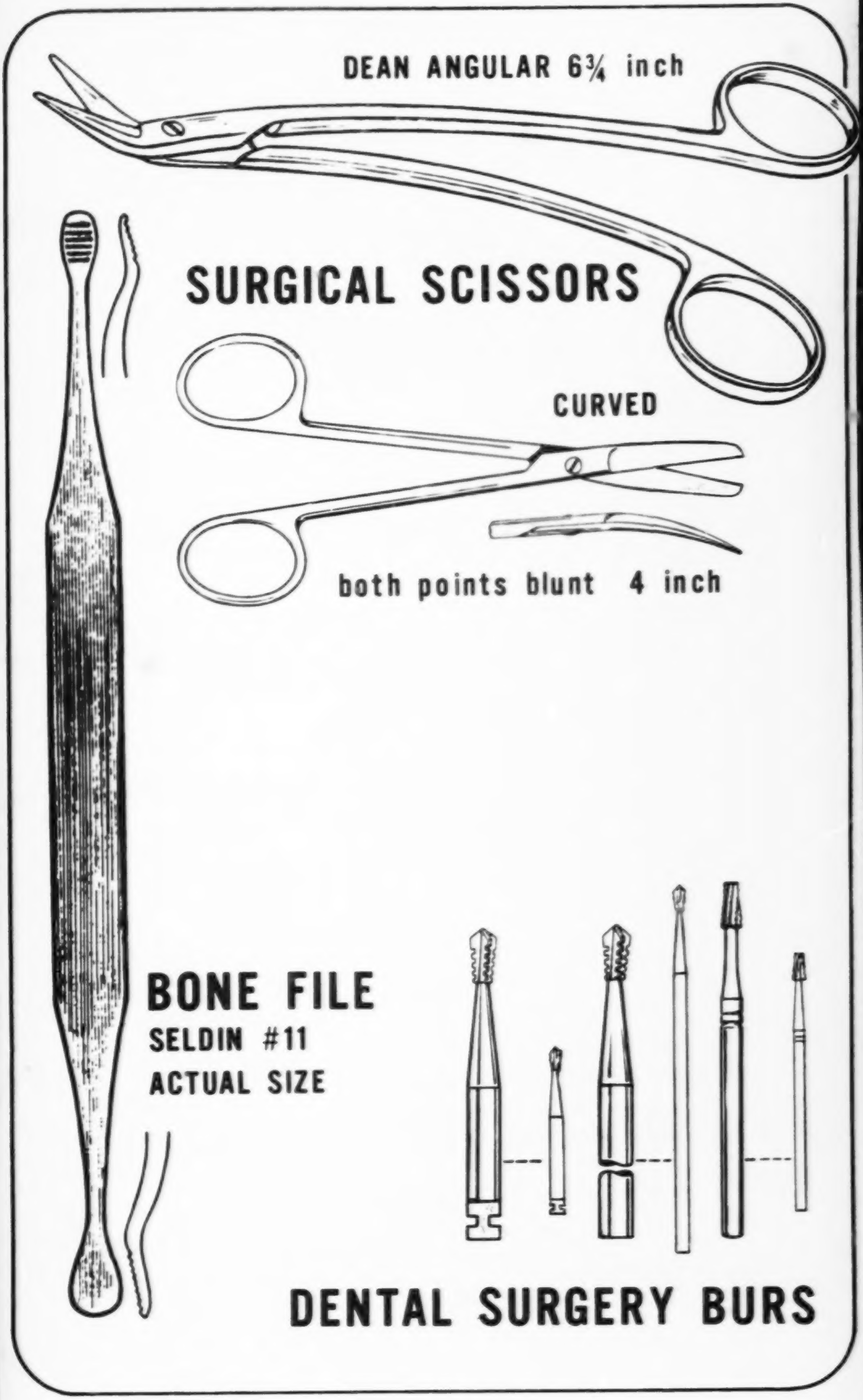
#1A

7 inch ACTUAL SIZE

RONGEUR FORCEPS



#4A



SURGICAL SCISSORS

DEAN ANGULAR 6¾ inch

CURVED

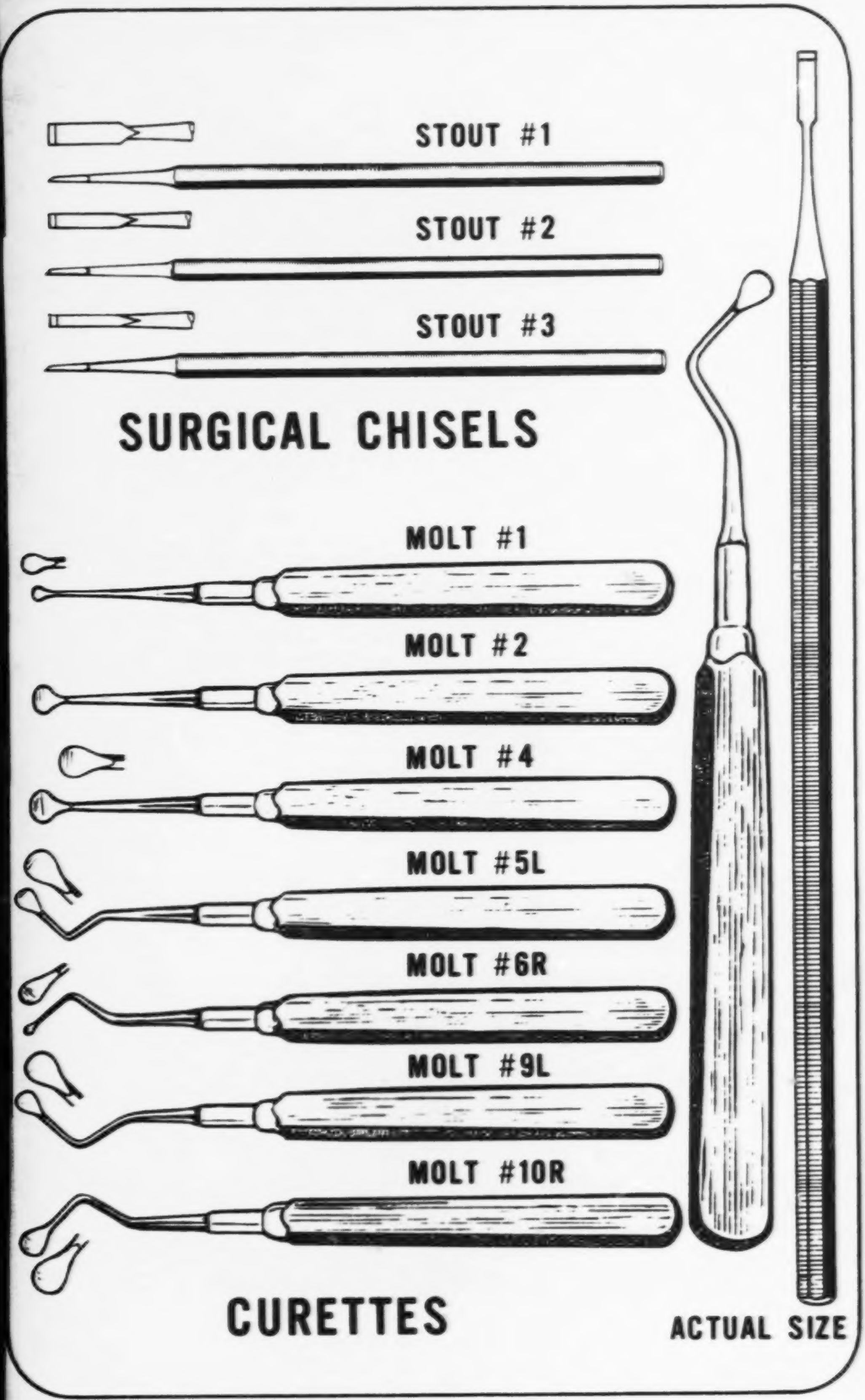
both points blunt 4 inch

BONE FILE

SELDIN #11

ACTUAL SIZE

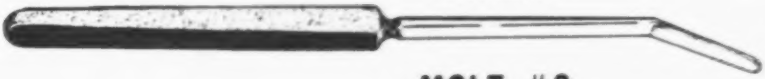
DENTAL SURGERY BURS


STOUT #1
STOUT #2
STOUT #3
SURGICAL CHISELS
MOLT #1
MOLT #2
MOLT #4
MOLT #5L
MOLT #6R
MOLT #9L
MOLT #10R
CURETTES
ACTUAL SIZE

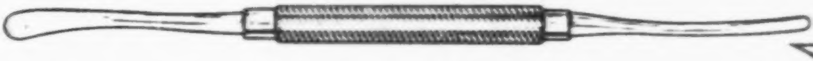
Foldout 14. Miscellaneous forceps and cutting instruments.

ELEVATORS

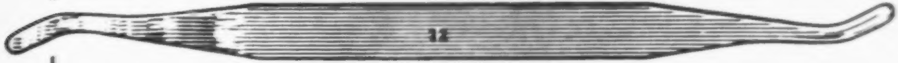
MALAR



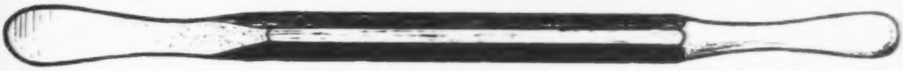
MOLT #9



SELDIN #22

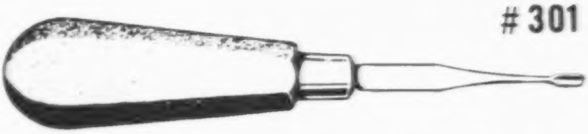


SELDIN #23

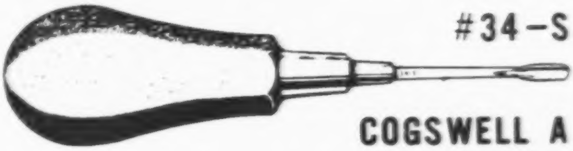


PERIOSTEAL

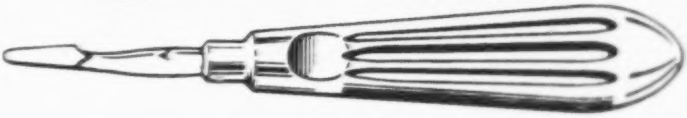
#301



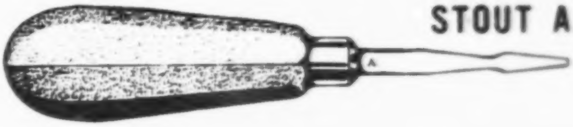
#34-S



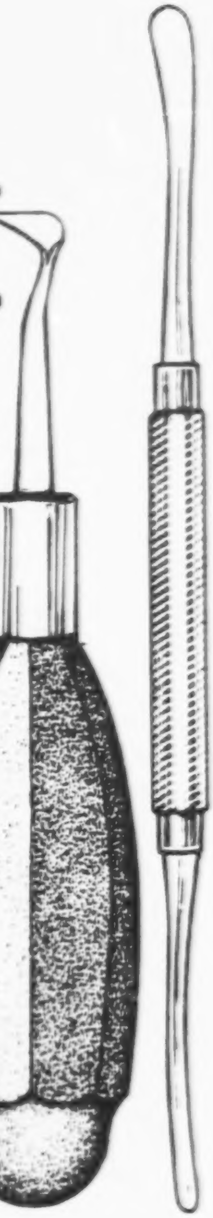
COGSWELL A



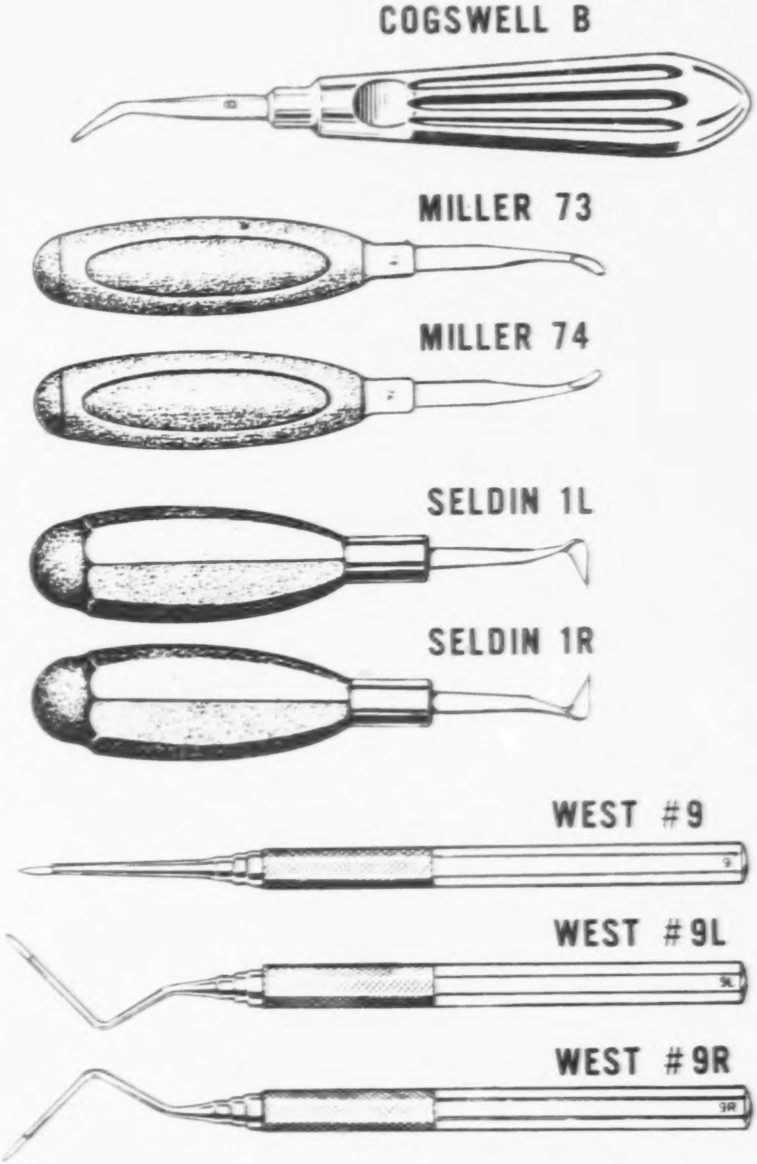
STOUT A



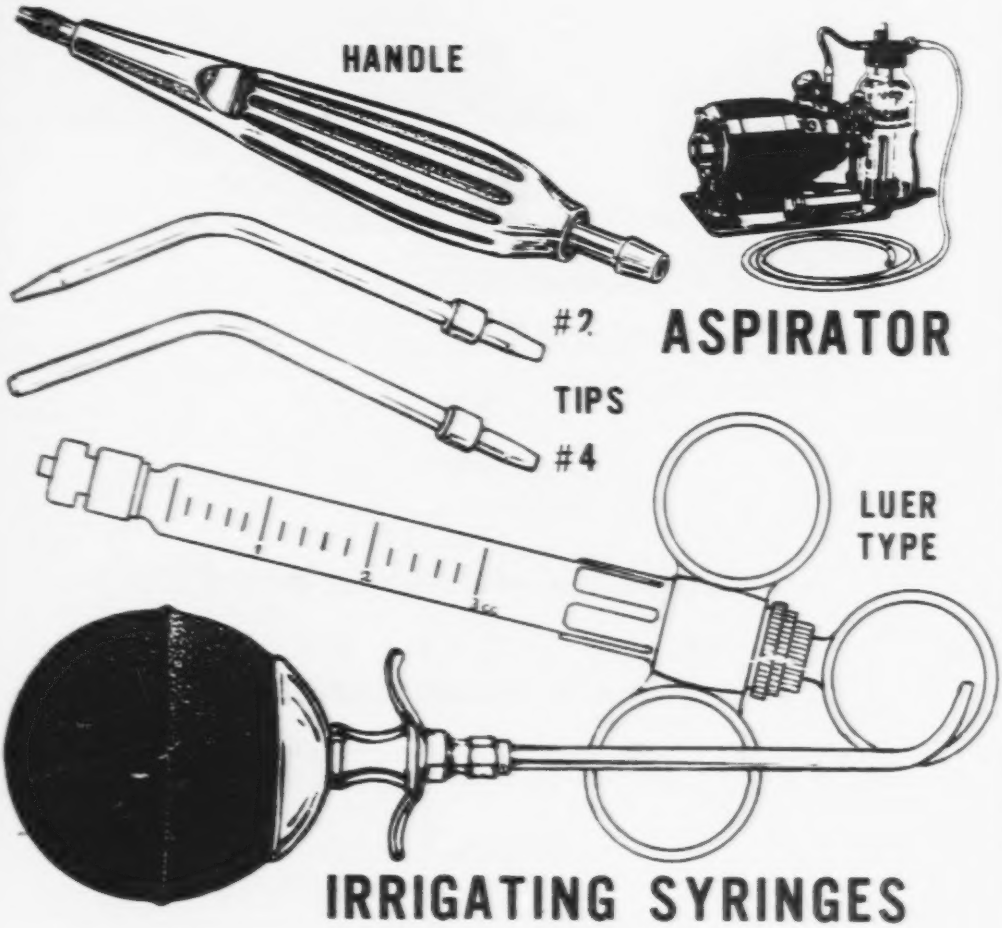
ROOT ELEVATORS



ACTUAL SIZE

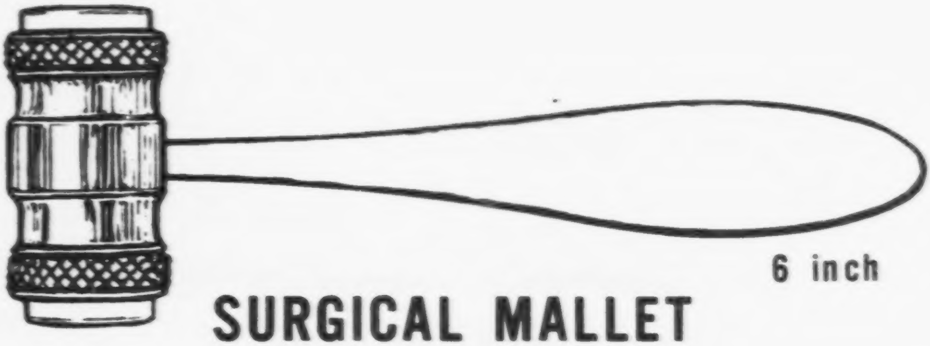

COGSWELL B
MILLER 73
MILLER 74
SELDIN 1L
SELDIN 1R
WEST #9
WEST #9L
WEST #9R

ELEVATORS

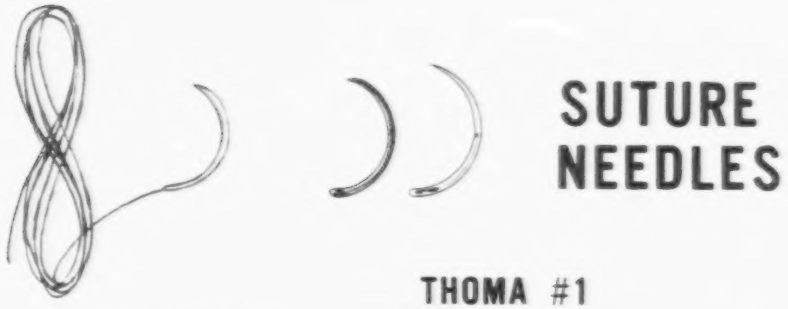

HANDLE
#2
TIPS
#4
LUER TYPE
1
2
3cc

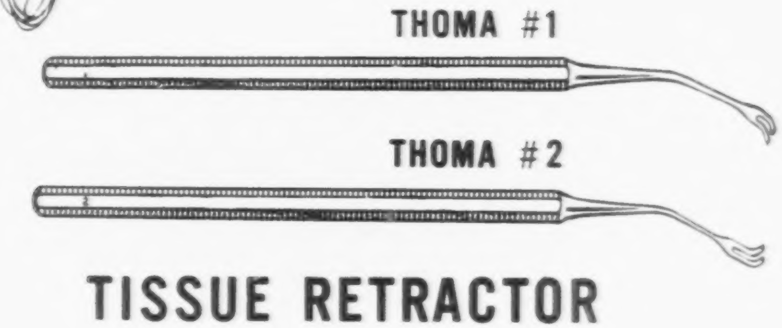
ASPIRATOR

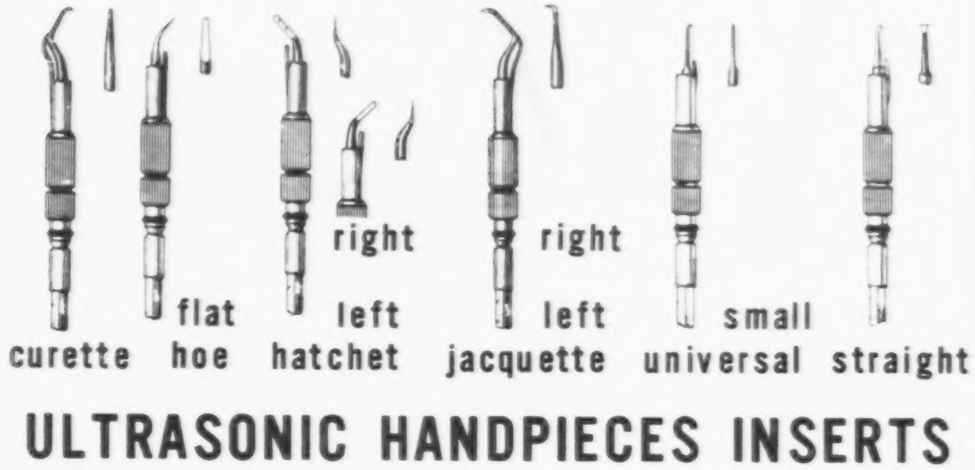
IRRIGATING SYRINGES



SURGICAL MALLET


SUTURE
NEEDLES

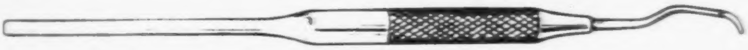

THOMA #1
THOMA #2
TISSUE RETRACTOR


right
right
flat
left
left
small
curette
hoe
hatchet
jacquette
universal
straight
ULTRASONIC HANDPIECES INSERTS

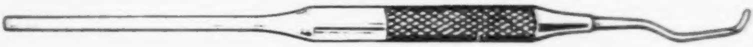
Foldout 15. Elevators and miscellaneous surgical instruments.

PERIODONTAL CURETTES

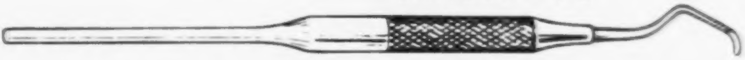
GRACEY #1



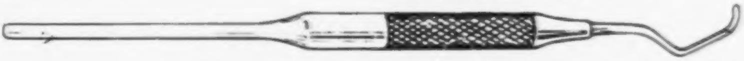
GRACEY #2



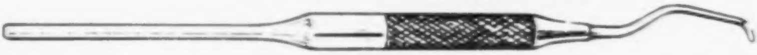
GRACEY #3



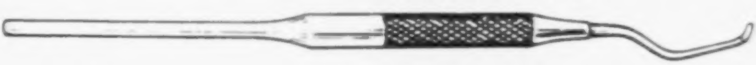
GRACEY #4



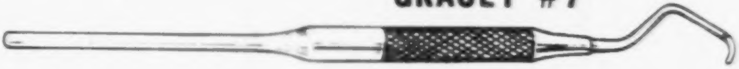
GRACEY #5



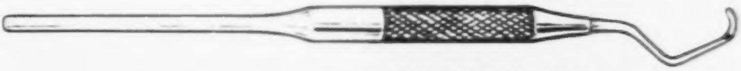
GRACEY #6



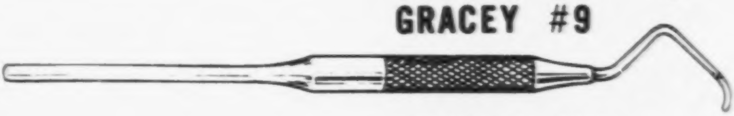
GRACEY #7



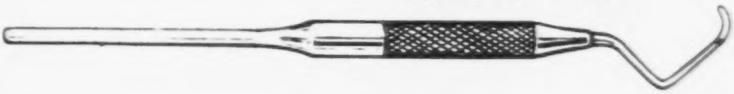
GRACEY #8

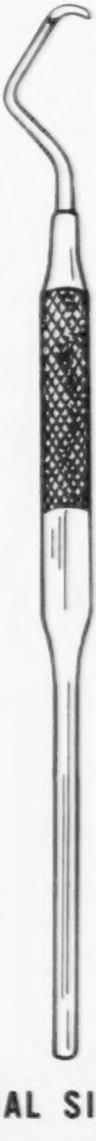


GRACEY #9

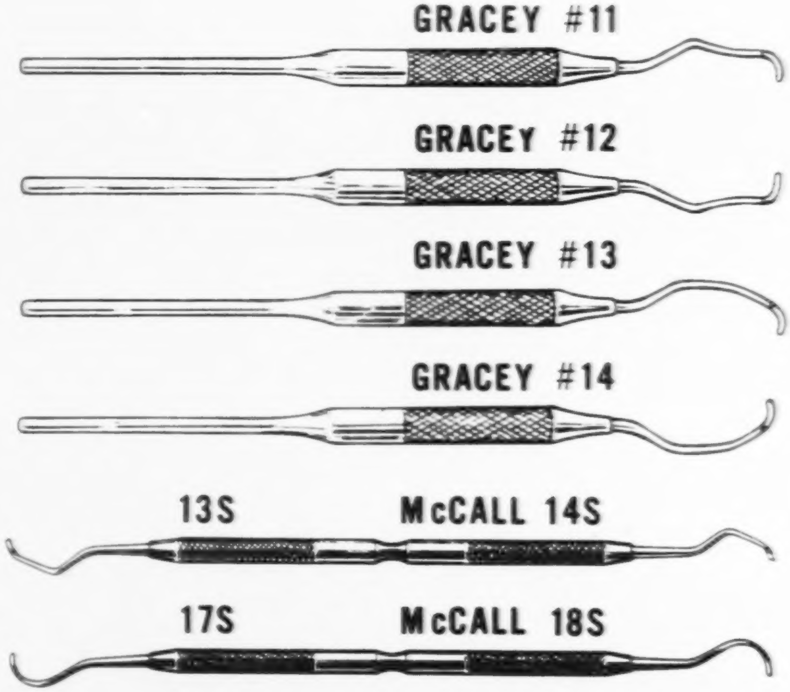


GRACEY #10

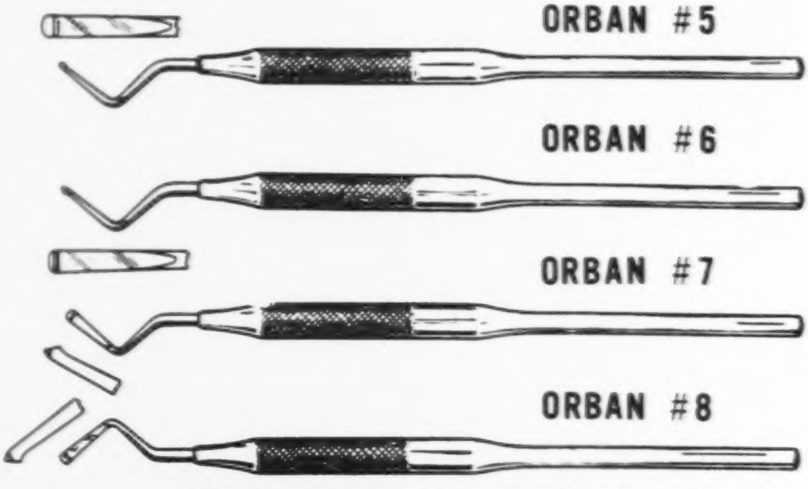




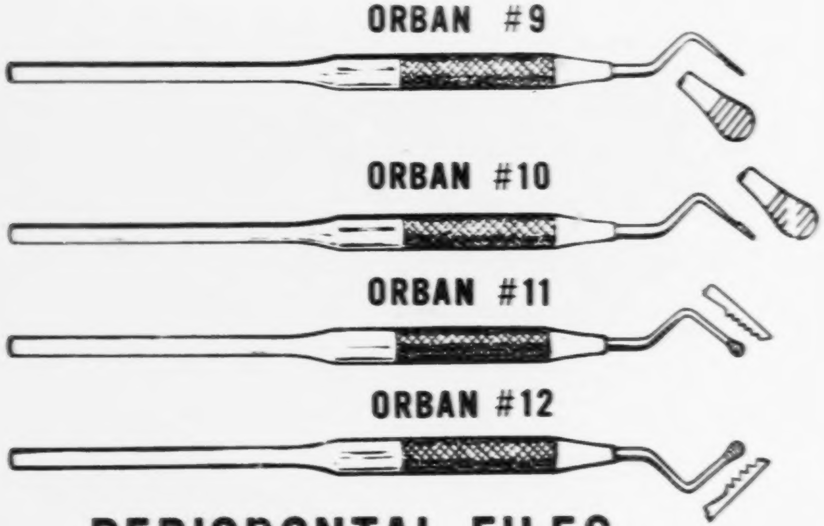
ACTUAL SIZE


GRACEY #11
GRACEY #12
GRACEY #13
GRACEY #14
13S
McCALL 14S
17S
McCALL 18S

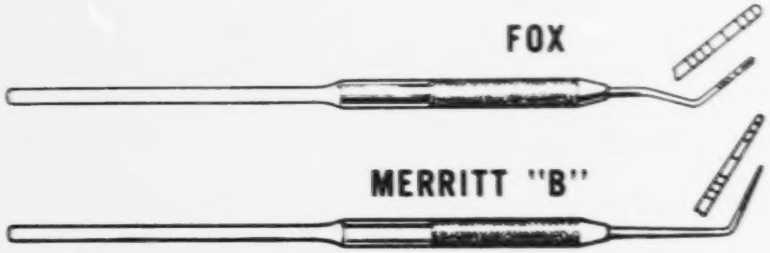
PERIODONTAL CURETTES


ORBAN #5
ORBAN #6
ORBAN #7
ORBAN #8

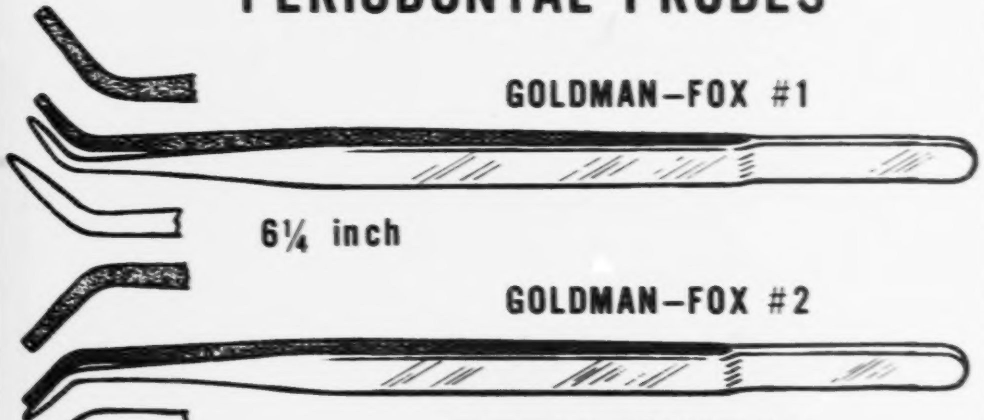
PERIODONTAL HOES


ORBAN #9
ORBAN #10
ORBAN #11
ORBAN #12

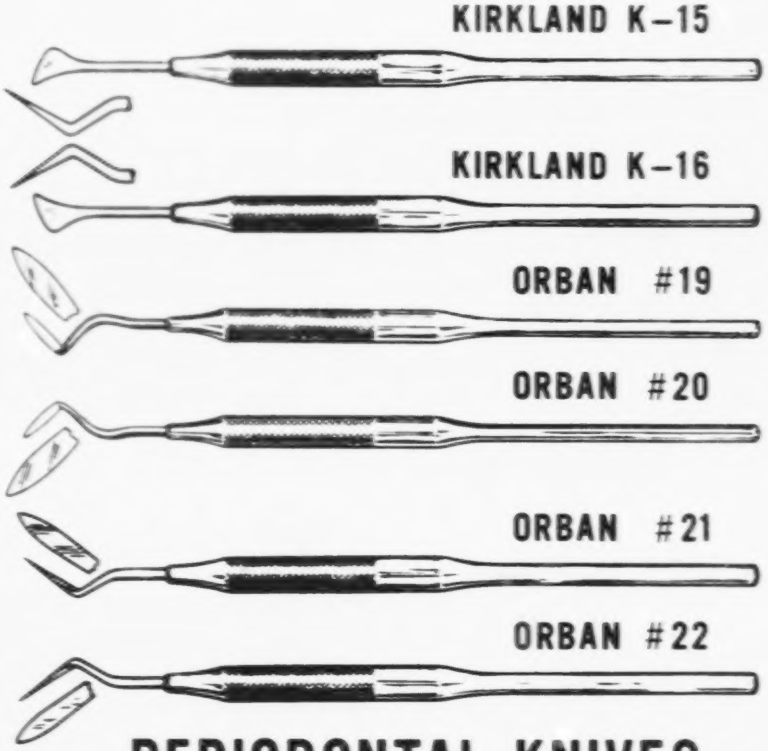
PERIODONTAL FILES


FOX
MERRITT "B"

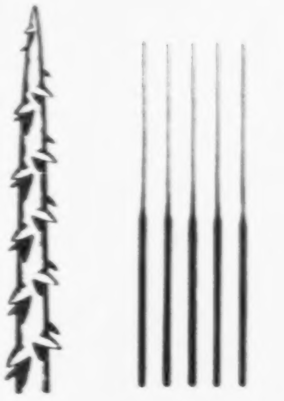
PERIODONTAL PROBES

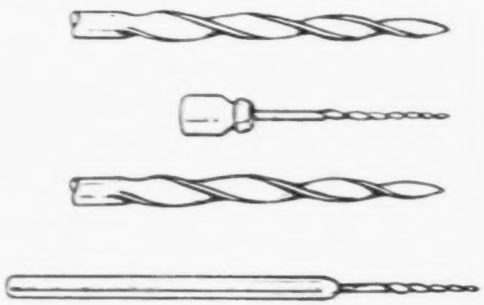

GOLDMAN-FOX #1
6¼ inch
GOLDMAN-FOX #2

PERIODONTAL POCKET MARKING FORCEPS


KIRKLAND K-15
KIRKLAND K-16
ORBAN #19
ORBAN #20
ORBAN #21
ORBAN #22

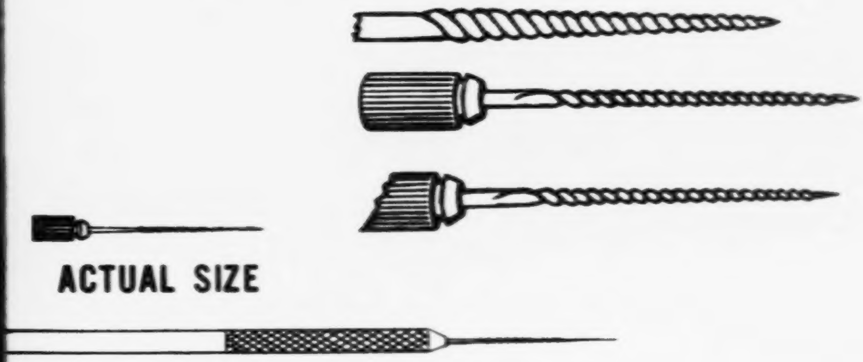
PERIODONTAL KNIVES


ACTUAL SIZE

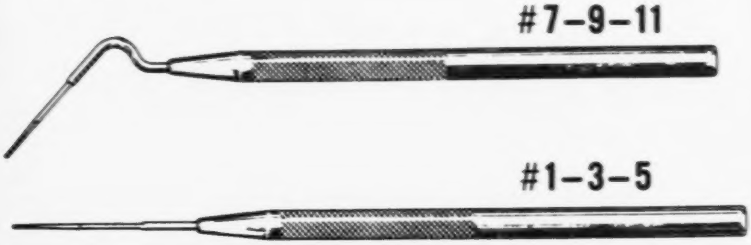


REAMERS

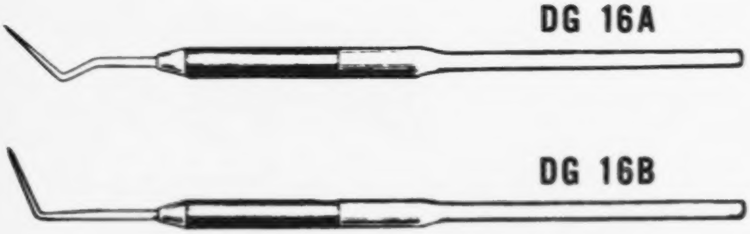
ROOT CANAL BROACHES & BROACH HOLDER


ACTUAL SIZE

ROOT CANAL FILES

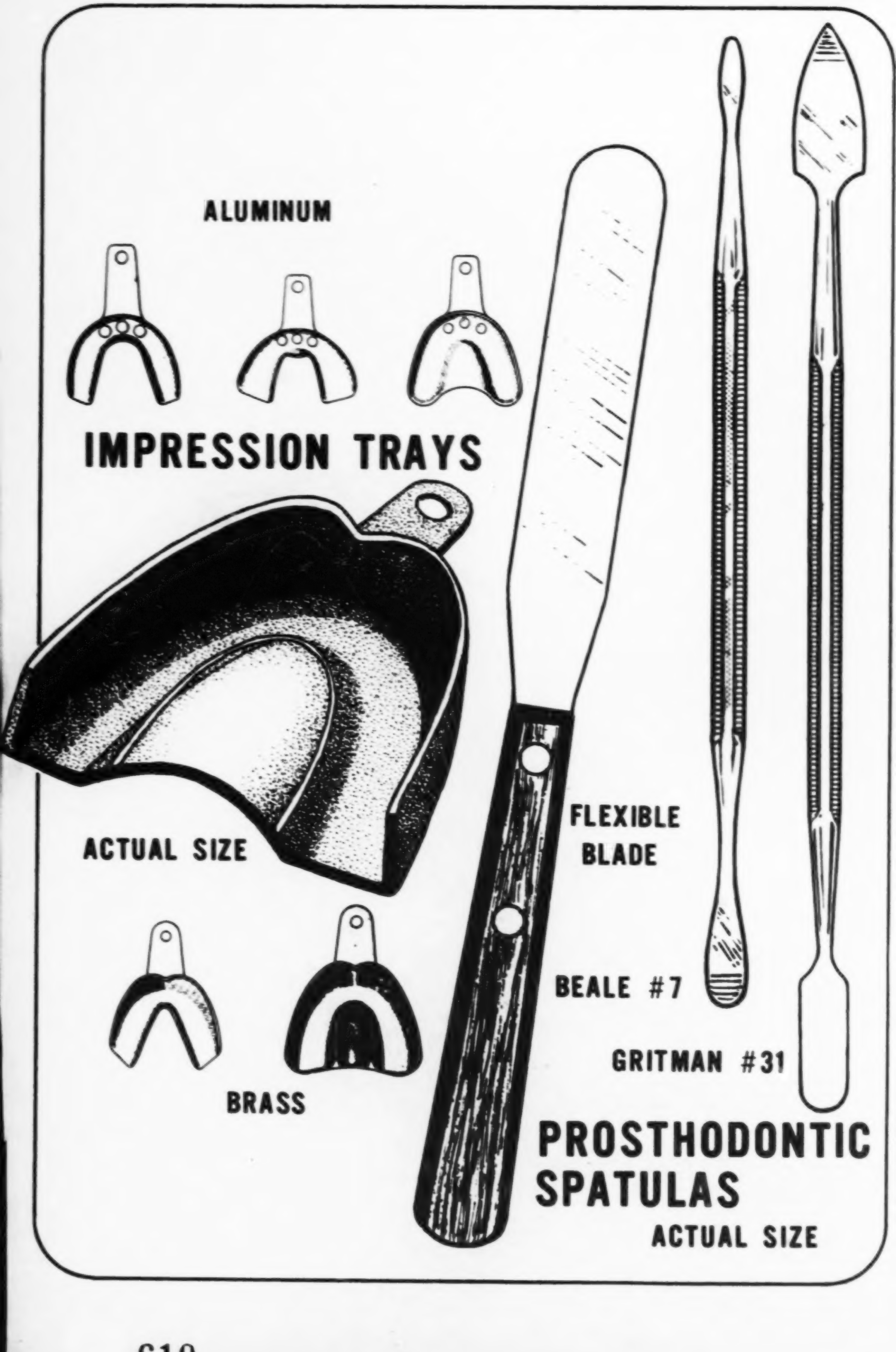


ROOT CANAL PLUGGERS


DG 16A
DG 16B

ENDODONTIC EXPLORERS

Foldout 16. Periodontal and endodontic instruments.

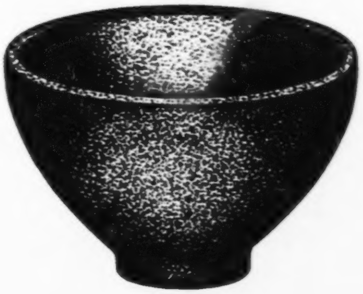


IMPRESSION TRAYS

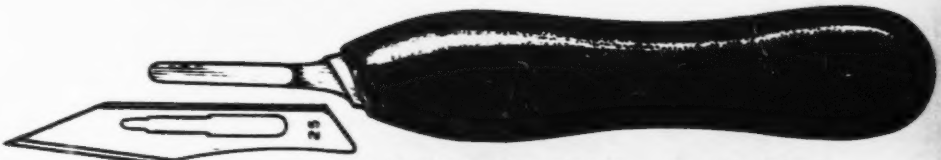
ALUMINUM
ACTUAL SIZE
BRASS

PROSTHODONTIC SPATULAS

FLEXIBLE BLADE
BEALE #7
GRITMAN #31
ACTUAL SIZE

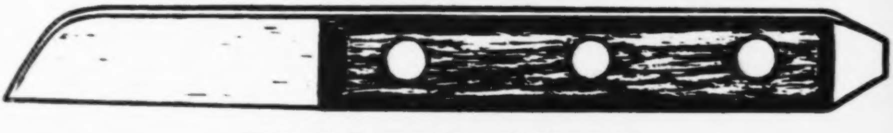


MIXING BOWL

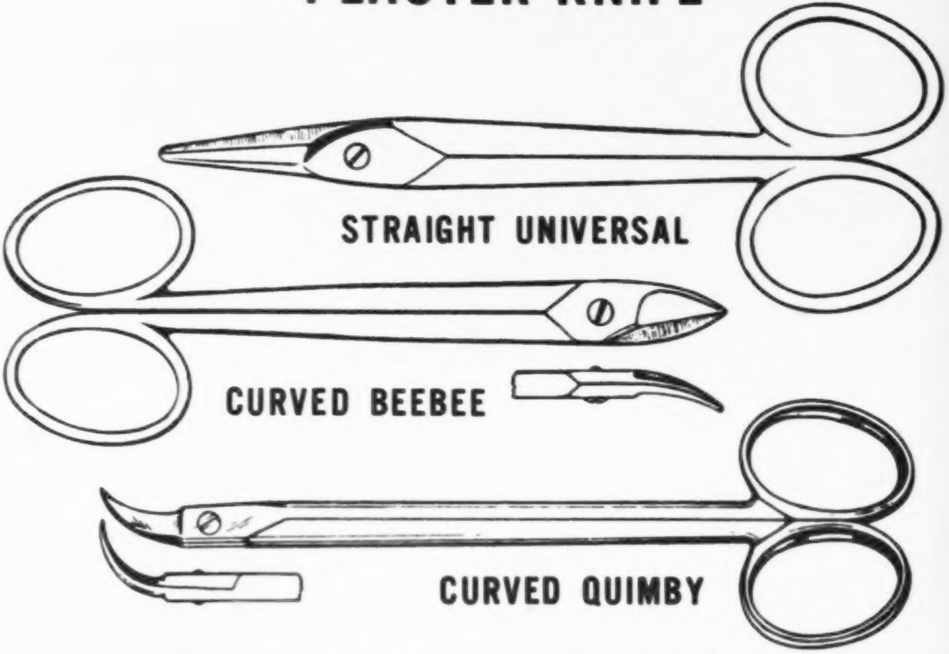


#25 BLADE

COMPOUND KNIFE



PLASTER KNIFE



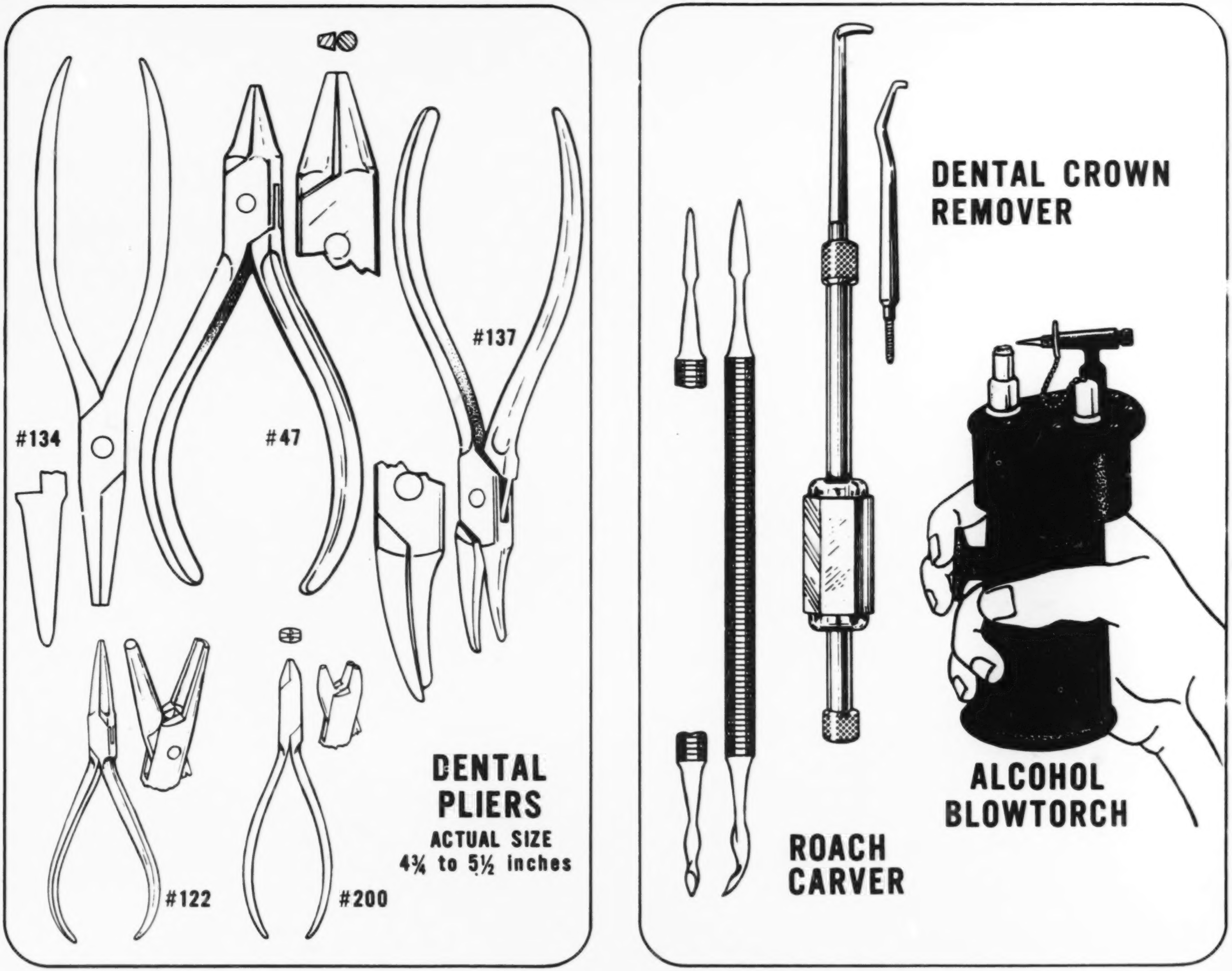
STRAIGHT UNIVERSAL

CURVED BEEBEE

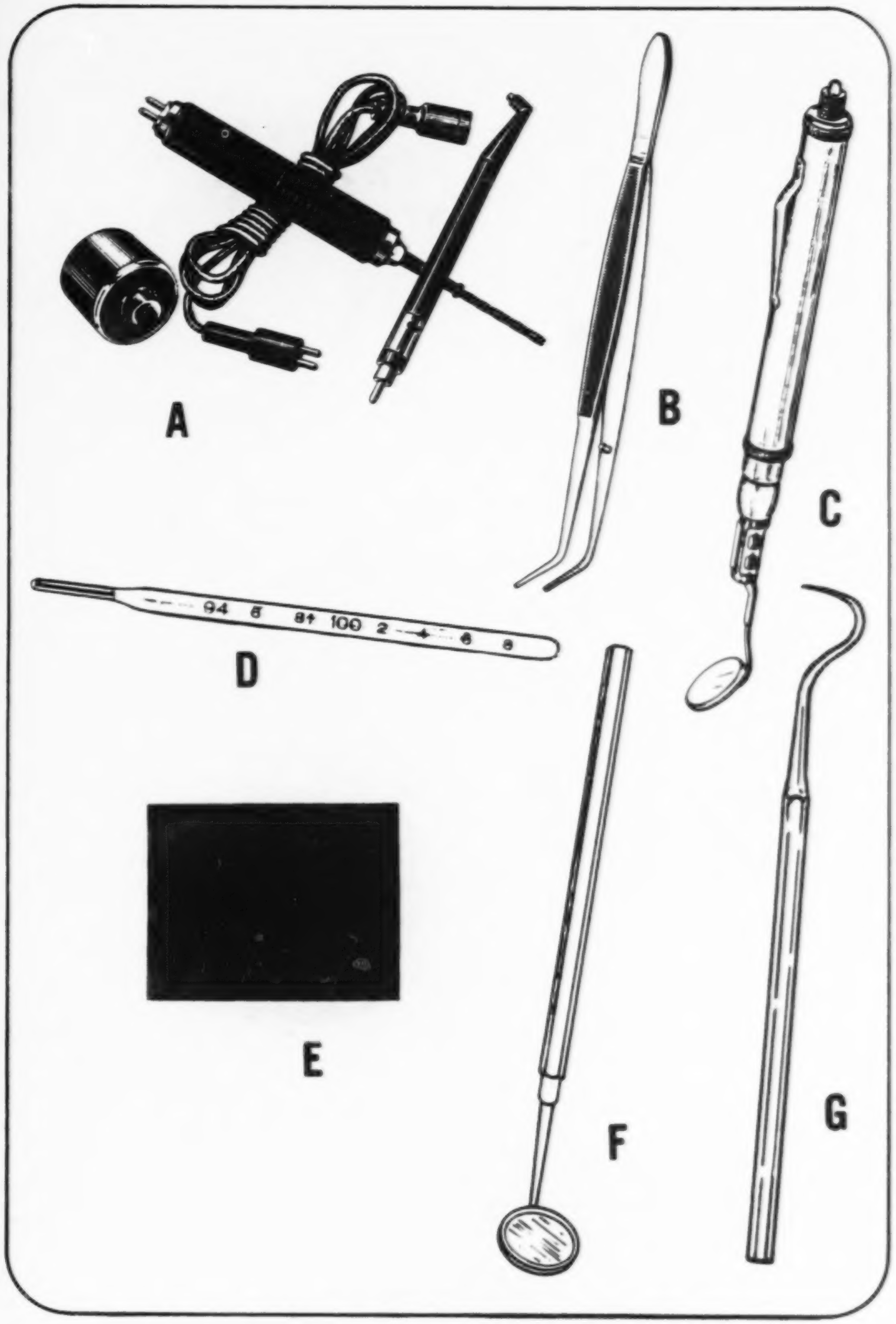
CURVED QUIMBY

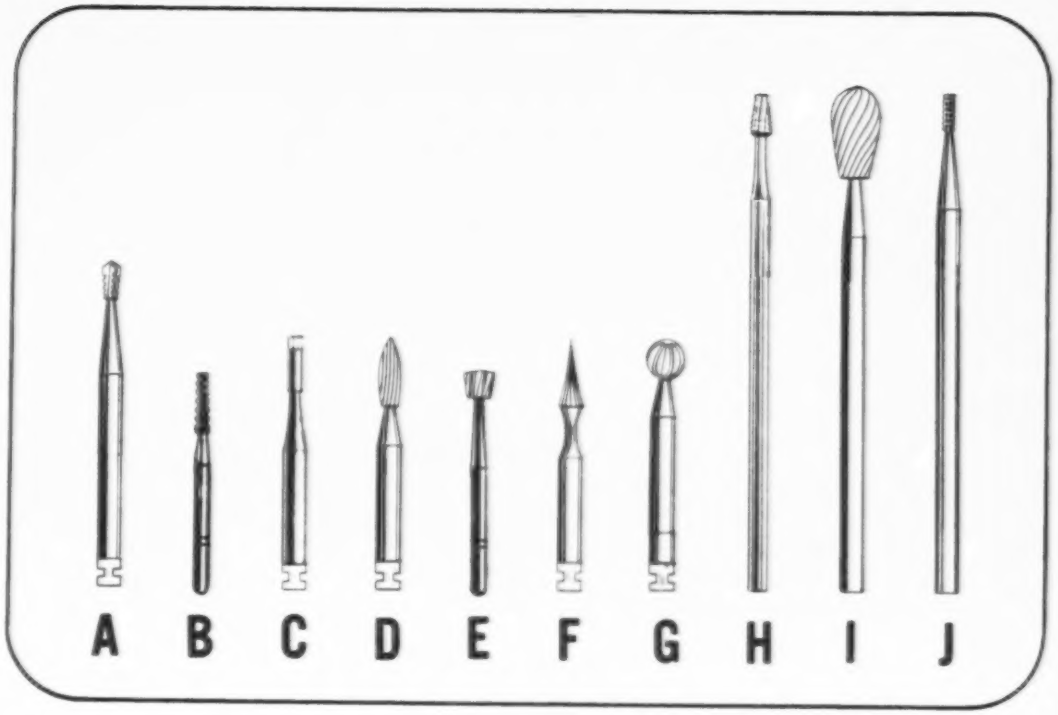
COLLAR & CROWN SCISSORS

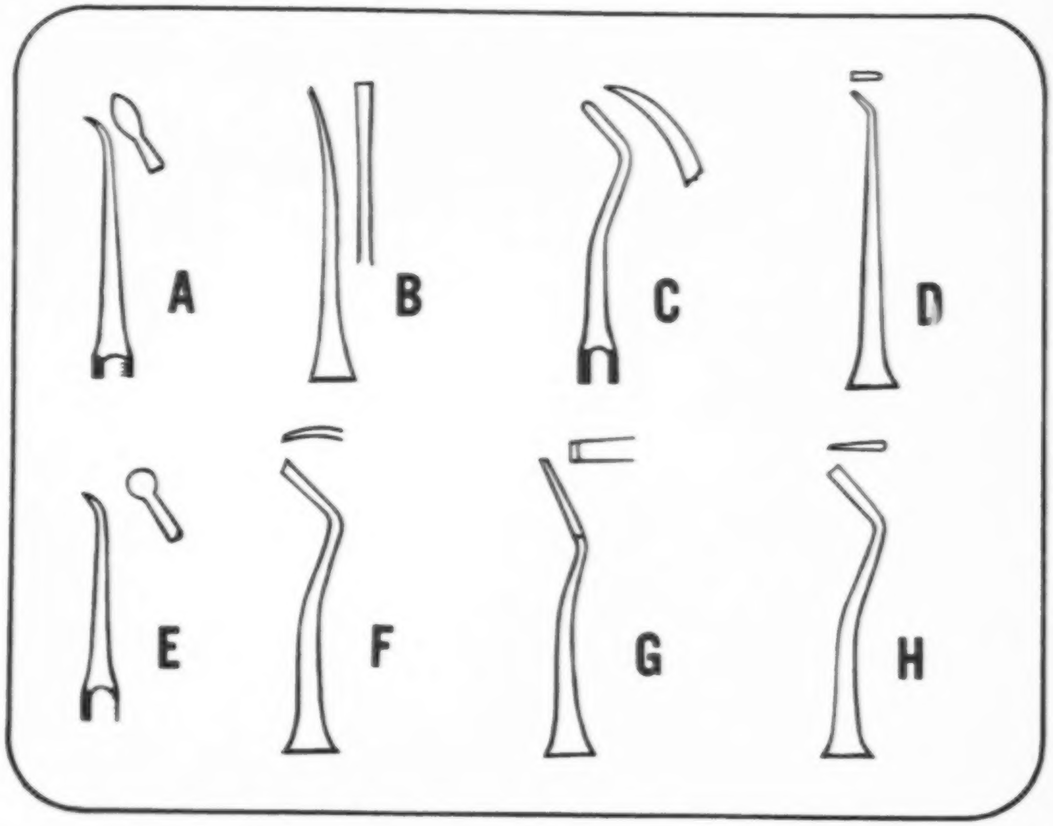
ACTUAL SIZES


#134
#47
#137
#122
#200
DENTAL
PLIERS
ACTUAL SIZE
4¾ to 5½ inches
DENTAL CROWN
REMOVER
ROACH
CARVER
ALCOHOL
BLOWTORCH

Foldout 17. Prosthodontic instruments.


A
B
C
94 6 8 100 2 6 8
D
E
F
G


A
B
C
D
E
F
G
H
I
J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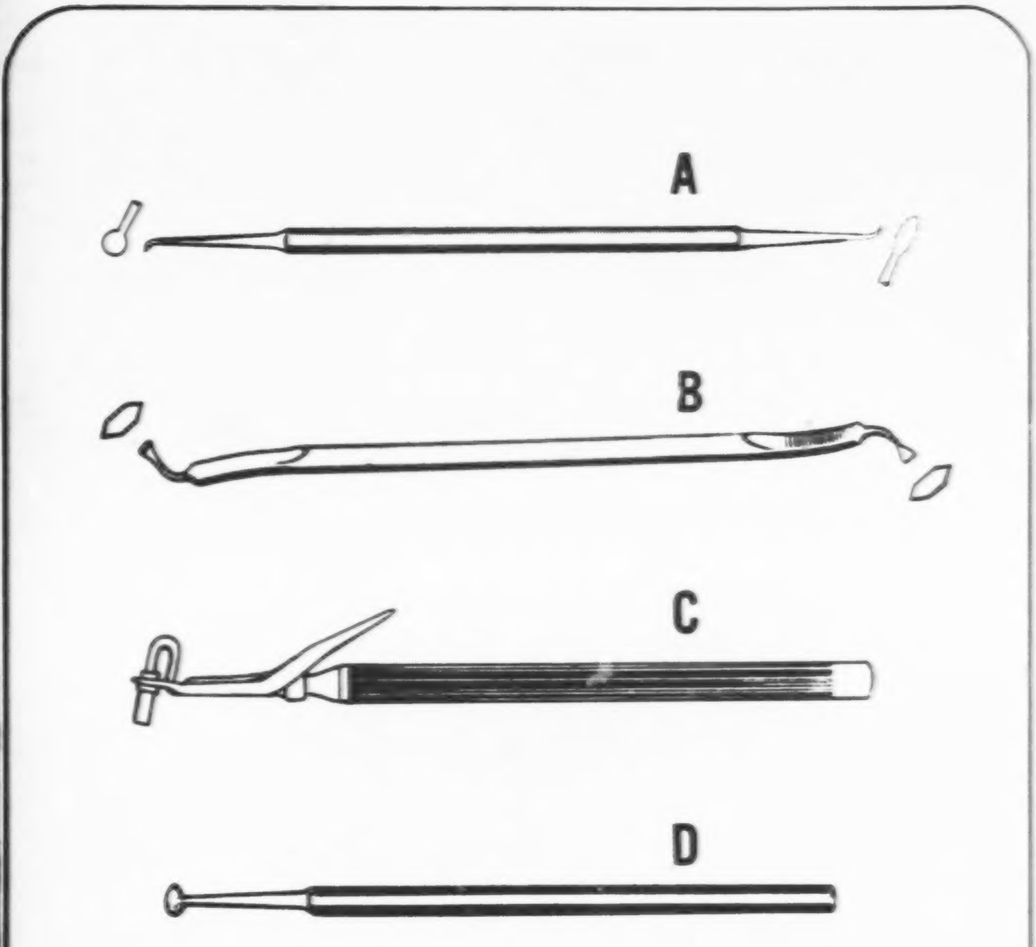
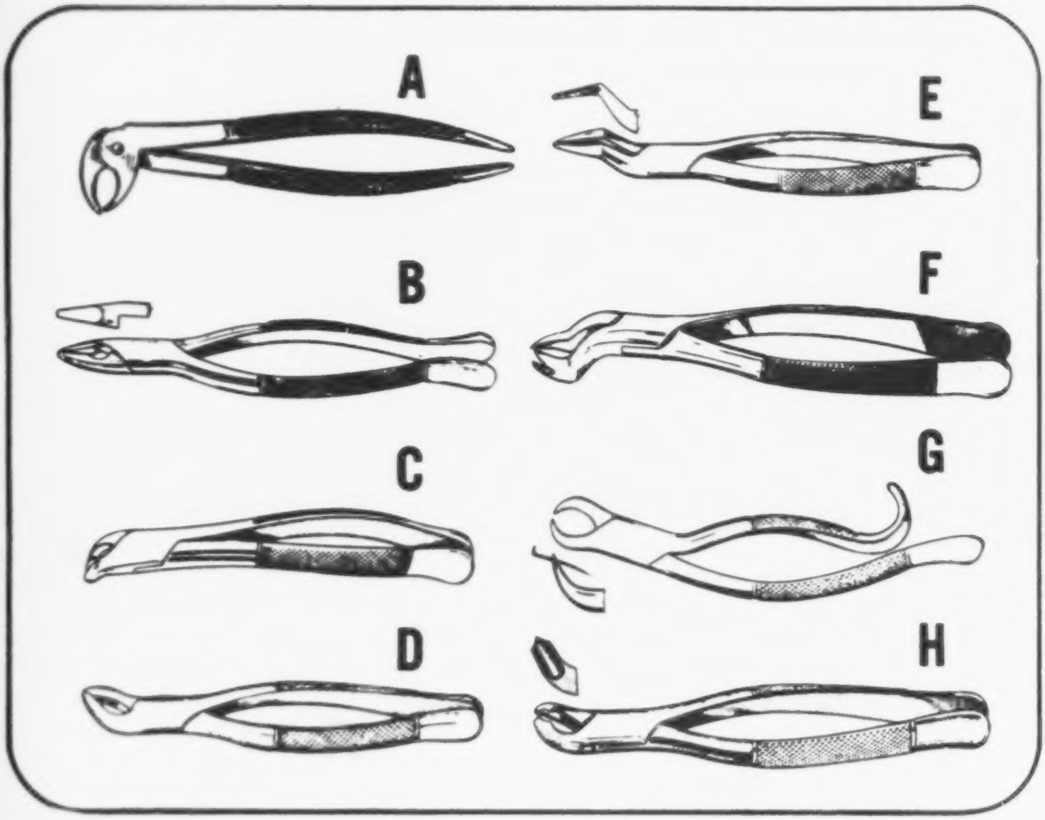


Foldout 18. Instruments; objective exercises 437, 438, 441, and 443.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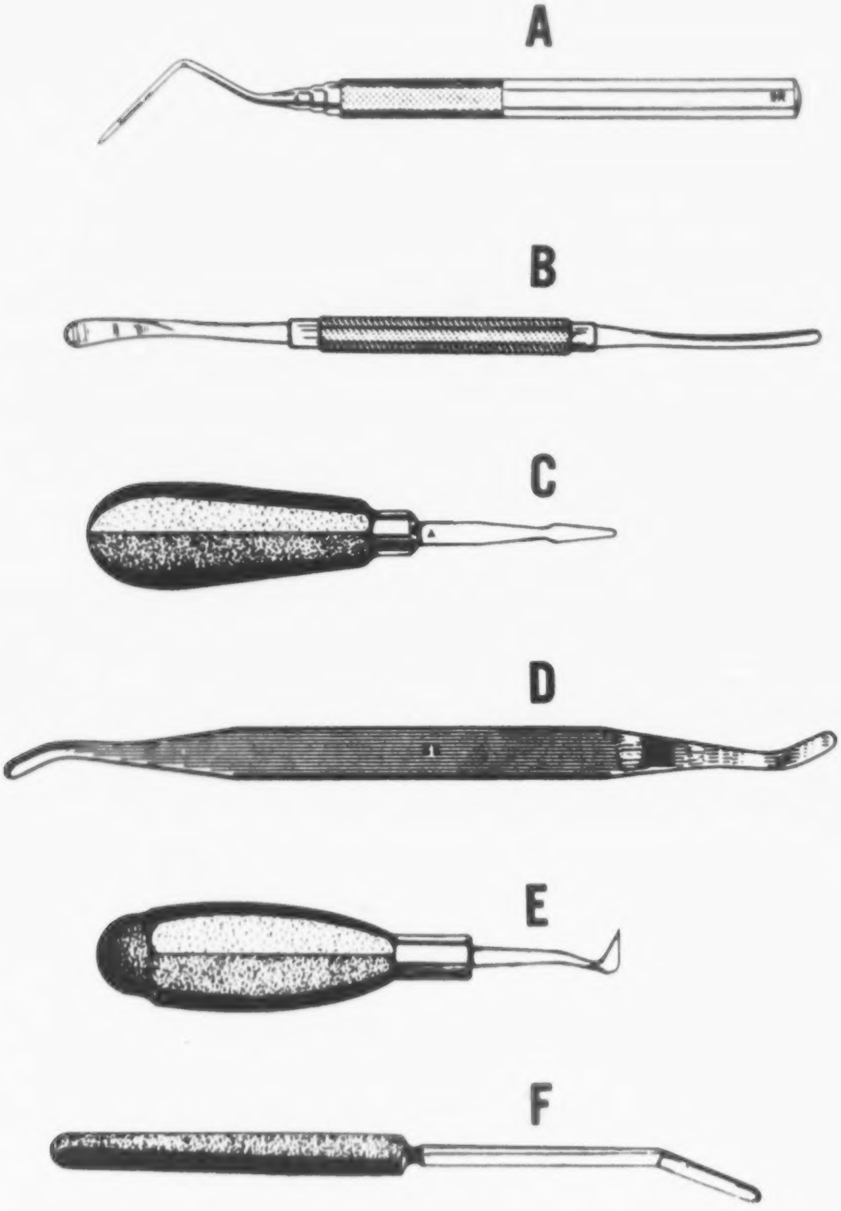
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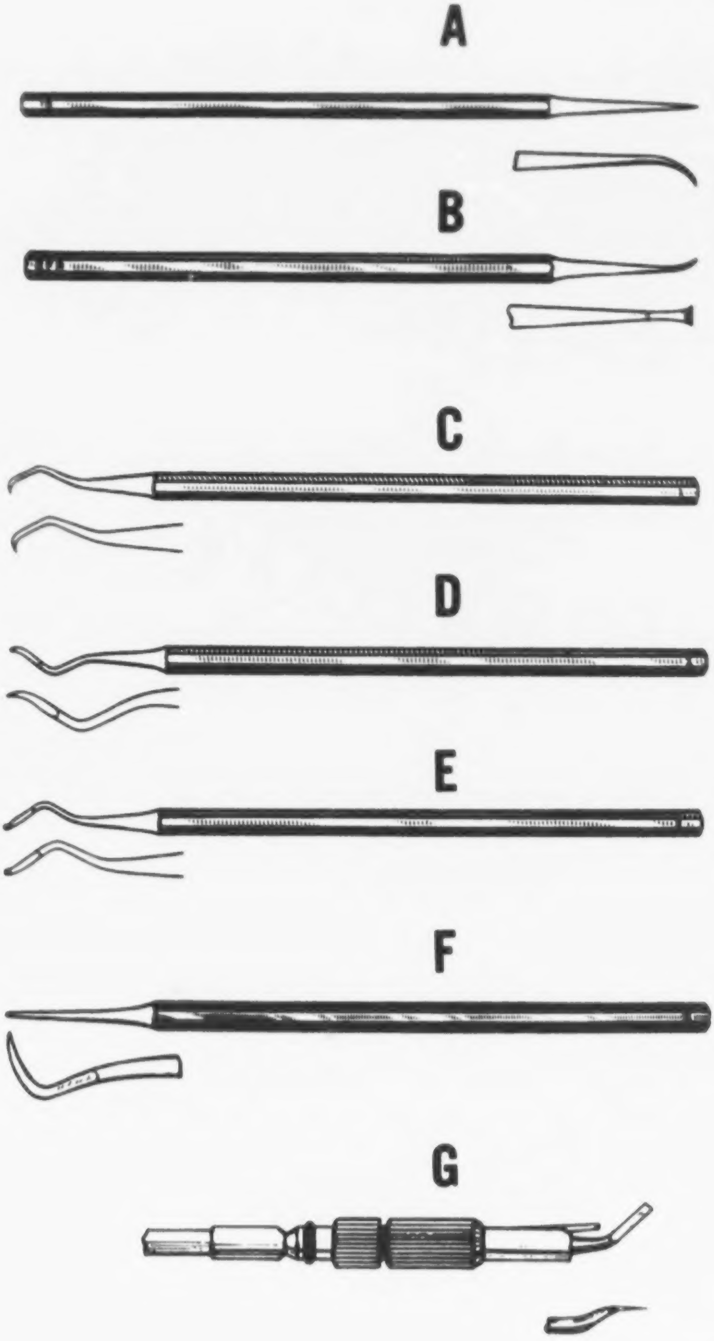
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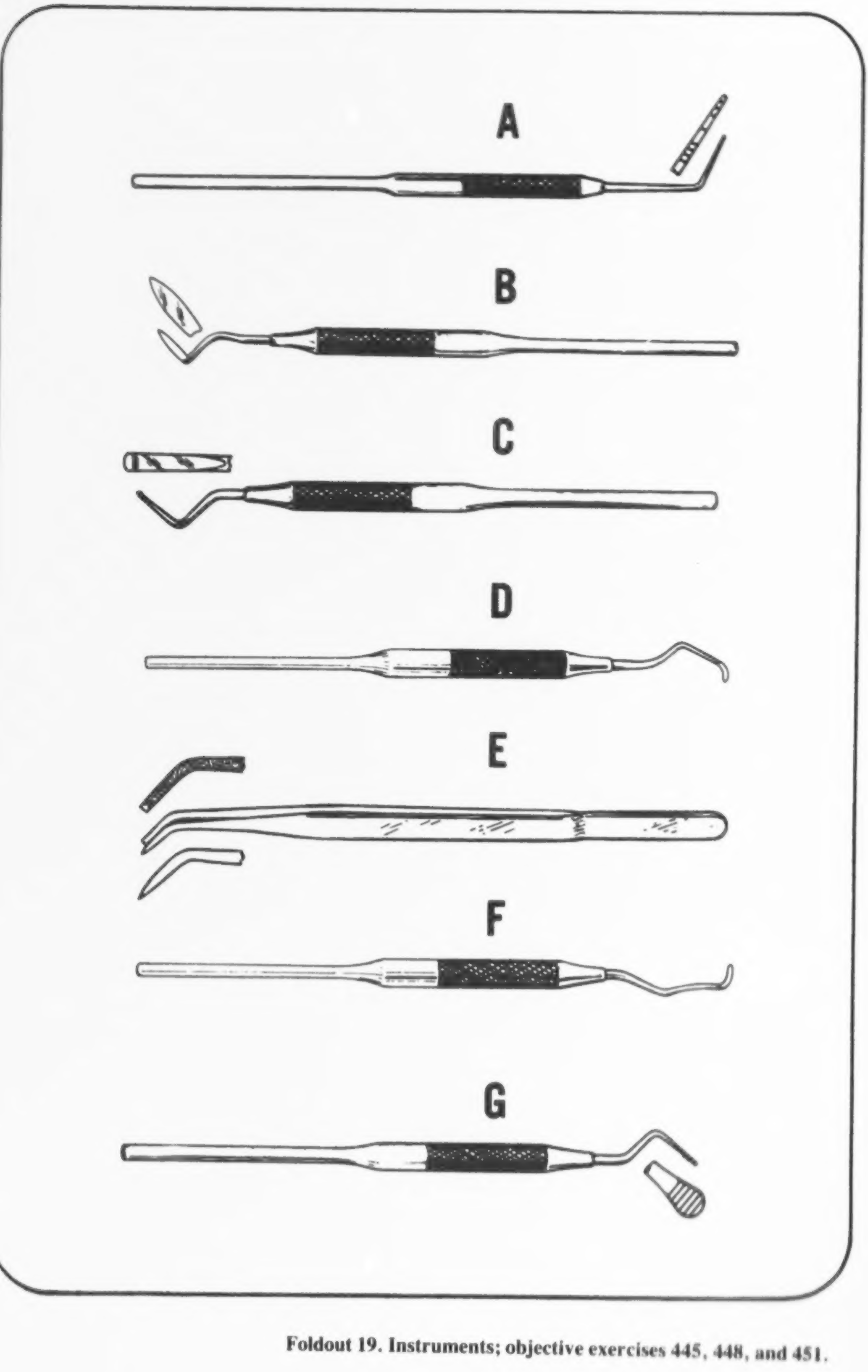

Foldout 19. Instruments; objective exercises 445, 448, and 451.

STOP- 1. MATCH ANSWER SHEET TO THIS EXERCISE NUMBER.
2. USE NUMBER 2 PENCIL ONLY.

EXTENSION COURSE INSTITUTE
VOLUME REVIEW EXERCISE

98150 04 01

DENTAL RADIOLOGY AND PREVENTIVE DENTISTRY

Carefully read the following:

DO's:

1. Check the "course," "volume," and "form" numbers from the answer sheet address tab against the "VRE answer sheet identification number" in the righthand column of the shipping list. If numbers do not match, return the answer sheet and the shipping list to ECI immediately with a note of explanation.
2. Note that item numbers on answer sheet are sequential in each column.
3. Use a medium sharp #2 black lead pencil for marking answer sheet.
4. Write the correct answer in the margin at the left of the item. (When you review for the course examination, you can cover *your* answers with a strip of paper and then check your review answers against your original choices.) After you are sure of your answers, transfer them to the answer sheet. If you *have* to change an answer on the answer sheet, be sure that the erasure is complete. Use a clean eraser. But try to avoid any erasure on the answer sheet if at all possible.
5. Take action to return entire answer sheet to ECI.
6. Keep Volume Review Exercise booklet for review and reference.
7. If *mandatorily* enrolled student, process questions or comments through your unit trainer or OJT supervisor. If *voluntarily* enrolled student, send questions or comments to ECI on ECI Form 17.

DON'Ts:

1. Don't use answer sheets other than one furnished specifically for each review exercise.
2. Don't mark on the answer sheet except to fill in marking blocks. Double marks or excessive markings which overflow marking blocks will register as errors.
3. Don't fold, spindle, staple, tape, or mutilate the answer sheet.
4. Don't use ink or any marking other than a #2 black lead pencil.

NOTE: **NUMBERED LEARNING OBJECTIVE REFERENCES ARE USED ON THE VOLUME REVIEW EXERCISE.** In parenthesis after each item number on the VRE is the *Learning Objective Number* where the answer to that item can be located. When answering the items on the VRE, refer to the *Learning Objectives* indicated by these *Numbers*. The VRE results will be sent to you on a postcard which will list the *actual* VRE *items you missed*. Go to the VRE booklet and locate the *Learning Objective Numbers* for the items missed. Go to the text and carefully review the areas covered by these references. Review the entire VRE again before you take the closed-book Course Examination.

MULTIPLE CHOICE

Note to Student: Consider all choices carefully and select the *best* answer to each question.

1. (600) Which of the following dental conditions *cannot* be diagnosed through an X-ray examination?

   a. Dental caries.
   b. Periapical abscesses.
   c. Acute gingivitis.
   d. Impacted teeth.

2. (601) Compared to visible light, the speed of X-rays is

   a. somewhat slower.
   b. about the same.
   c. considerably slower.
   d. considerably faster.

3. (601) What special effect do X-rays have on certain chemical crystals, such as calcium tungstate?

   a. Fluorescent.
   b. Biological.
   c. Penetrating.
   d. Photographic.

4. (602) What is the purpose of the copper head and stem of the positive terminal of the X-ray tube?

   a. To dissipate heat.
   b. To reflect X-rays.
   c. To produce X-rays.
   d. To warm the tube head.

5. (602) Which of the following is typically descriptive of X-rays produced by low voltage?

   a. *No* penetration.
   b. Low penetration.
   c. Short wavelength and high penetration.
   d. Extremely hazardous due to its shorter wavelength.

6. (603) You find that a patient has been exposed to radiation about his or her head and neck area within the preceding week. Considering the hazards of radiation, the wisest action for you to take is to

   a. defer X-ray dental exposure.
   b. proceed with normal X-ray exposure.
   c. proceed with only half of normal X-ray exposure.
   d. defer X-ray dental exposure until you consult with the dental officer for guidance.

7. (603) Leakage radiation that comes from part of the X-ray machine other than the focal spot, such as the tube housing and head assembly, is best referred to as

   a. primary.
   b. indirect.
   c. secondary.
   d. either primary or secondary.

8. (604) What is the purpose of the aluminum disk which is located where the X-rays exit the tube head?

   a. It serves to intensify the total quantity of radiation.
   b. It limits the diameter of the useful beam to under 3 inches.
   c. It increases the wavelength of the exiting radiation and decreases the exposure time.
   d. It absorbs poor quality radiation that would normally be absorbed by the patient's skin.

9. (605) How should the printed dot on the periapical film packet be positioned when you are making an exposure?

   a. Toward the lingual surface of the teeth.
   b. Toward the facial surface of the teeth.
   c. So that it is superimposed over the tooth's apical region.
   d. Toward the occlusal or incisal surface of the teeth.

10. (605) The reason for two films in the occlusal type packet is to allow for

a. different developing times.
b. superimposition of an embossed dot over the proper tooth.
c. a range of mouth sizes from child to adult.
d. two X-rays, one of the upper teeth and the other of the lower teeth.

11. (605) Which code letter identifies ultraspeed radiographic film?

a. A.
b. B.
c. C.
d. D.

12. (606) Enlargement of the image is reduced in the long-cone technique of exposing radiographs, as compared to the short-cone technique, because the focal-film distance is

a. decreased to approximately 8 inches.
b. increased to approximately 12 inches.
c. increased to approximately 16 to 20 inches.
d. decreased to approximately 16 to 20 inches.

13. (607) The best technique in establishing a parallel relationship between the film packet and the structures to be radiographed is to

a. use the X-C-P instrument.
b. adjust the patient's head and body positioning.
c. maneuver the X-ray unit with the patient in a sitting position.
d. set kilovolt and milliampere unit adjustments to minimum settings and time exposure to maximum settings.

14. (607) In using the X-C-P instrument, how should the film be inserted into the slot for anterior exposures?

a. Vertically.
b. Horizontally.
c. With an upward motion.
d. Horizontally, after opening the slot with a screwdriver.

15. (607) In using the X-C-P instrument, how should the film be inserted into the slot for posterior exposures?

a. Vertically.
b. Horizontally.
c. With an upward motion.
d. Vertically, after opening the slot with a screwdriver.

16. (608) Which of the following teeth is centered on the film when exposing the maxillary bicuspid region?

a. Maxillary first molar.
b. Maxillary first bicuspid.
c. Maxillary second bicuspid.
d. Maxillary cuspid.

17. (608) When you take long cone radiographic exposures of the mandibular molar region, you should position the film in the mouth with the

a. second molar centered on the film.
b. first molar centered on the film.
c. anterior edge of the film centered on the second bicuspid.
d. anterior edge of the film centered on the first bicuspid.

18. (609) Where should the forward edge of the film packet be placed when you take bitewing radiographs?

a. Behind the distal one-third of the cuspids.
b. In the contact area between the bicuspids.
c. At the mesial surface of the first molar.
d. At the distal surface of the first molar.

19. (610) Which type of radiograph is of great value in diagnosing antral involvements?

a. Bitewing.
b. Pedodontic.
c. Occlusal.
d. Periapical.

20. (611) During occlusal exposures, the patient's median sagittal line should be kept

a. in the vertical plane.
b. in the horizontal plane.
c. perpendicular with the floor.
d. parallel with the floor.

21. (612) Which occlusal exposure is taken with the central ray directed 65° downward at the interior border of the nasal bones?

a. Mandibular anterior.
b. Mandibular posterior.
c. Maxillary anterior.
d. Maxillary posterior.

22. (613) Approximately how much radiation is received by a patient during a panographic examination, as compared to a conventional full mouth series?

a. One-tenth.
b. One-half.
c. The same.
d. Twice as much.

23. (613) Select the factor which normally limits the panographic X-ray technique to full mouth surveys.

a. Size factor.
b. Cost factor.
c. Distortion factor.
d. Time factor.

24. (614) Radiographic darkroom illumination is considered safe if it does *not* affect a film that has been exposed to it for a period of

a. 10 minutes.
b. 5 minutes.
c. 3 minutes.
d. 1 minute.

25. (615) What is the ideal time-temperature ratio for developing radiographic films?

a. 3 minutes at 75° F.
b. 5 minutes at 68° F.
c. 5 1/2 minutes at 65° F.
d. 6 1/2 minutes at 60° F.

26. (615) The developing solution should be discarded and replaced with a fresh solution when it turns a

a. light color.
b. straw color.
c. dark brown color.
d. light brown color.

27. (616) How many films are mounted in a cardboard folder to make up a full mouth periapical radiographic series?

a. Two.
b. Fourteen.
c. Twenty-eight.
d. One each for the central, cuspid, bicuspid, and molar areas.

28. (617) Radiographic quality which is determined by the degree of blackening of the film is called

a. detail.
b. density.
c. contrast.
d. herringbone image.

29. (617) The difference between the black, white, and various shades of gray on dental radiographs is referred to as

a. detail.
b. density.
c. contrast.
d. herringbone image.

30. (618) The dental X-ray analyzer quality control check of the radiographic process should be conducted

a. daily.
b. twice weekly.
c. weekly.
d. monthly.

31. (618) Film processed through the dental X-ray analyzer quality control check will be shaded

a. 1/3 black, 1/3 gray, and 1/3 clear.
b. 1/2 black, and 1/2 clear.
c. 1/3 brown, 1/3 gray, 1/3 black.
d. 1/2 gray and 1/2 clear.

32. (619) What are the three phases of the USAF Preventive Dentistry Program?

a. Examination, Prophylaxis, and Community.
b. Children's, Community, and Examination.
c. Clinical, Community, and Children's.
d. Prophylaxis, Clinical, and Examination.

33. (620) What is the purpose of the periodic dental examination?

a. Insure the currency of the dental health classification.
b. Early detection of oral pathology.
c. Proper custody of the dental health record.
d. All of the above.

34. (620) Which of the following publications outlines the dental health program for foodhandlers?

a. AFR 162-2.
b. AFR 163-8.
c. AFM 162-2.
d. AFM 163-8.

35. (621) Which of the following is a part of the Community Phase of the USAF Preventive Dentistry Program?

a. Construction of mouthguards.
b. Dental prophylaxis.
c. Fluoridation of water supplies.
d. Dental Health Program for Food Handlers.

36. (622) When do dependent children receive definitive dental treatment?

a. Dependents do not receive definitive dental treatment.
b. Upon request of the hospital commander.
c. When authorized by the base dental surgeon.
d. If the patient is located where dental care for family members is authorized.

37. (623) What is the key to success for any presentation?

a. Organization.
b. Establishing objectives.
c. Selecting a method of presentation.
d. Preparing the lesson plan.

38. (624) Training aids should be used to

a. replace part of your instruction.
b. supplement your instruction.
c. substitute instruction.
d. take the place of good teaching.

39. 9625) During your presentation, you can keep your voice interesting by

a. varying the pitch and force but maintaining a constant rate.
b. maintaining a constant pitch and rate but varying the force.
c. varying the pitch, rate, and force.
d. maintaining a constant pitch, rate and force.

40. (626) If a patient has either a history of angina pectoris or of diabetes, the one thing you should always do is to

a. administer antibiotics.
b. place a nitroglycerin tablet under his or her tongue.
c. check with the dental officer prior to treatment.
d. premedicate with penicillin or with anticoagulants.

41. (627) If deep periodontal pockets remain after normal tooth-scaling procedures have been properly completed, the final step in the eradication of pockets is to

a. mechanically fracture the calculus deposit.
b. remove all calculus from the crowns of the teeth.
c. apply basic fuchsin solution with a cotton applicator.
d. refer the patient to a dental officer for surgical removal of the packet.

42. (628) Approximately how much water is needed to keep the tip of the instrument used in the ultrasonic prophylaxis cool?

a. 25 cc per second.
b. 25 cc per minute.
c. 35 cc per second.
d. 35 cc per minute.

43. (628) If you are using the ultrasonic prophylaxis unit and desire to remove calculus and stain from very tight contacts requiring a sharp hook-type instrument, which type of tip should you select?

a. Hatchet scaler.
b. Straight scaler.
c. Small universal scaler.
d. Either a flat-hole chisel scaler or the curette.

44. (629) Hand scaling with curettes is superior to scaling with other hand instruments because curettes

a. are sharper than other hand instruments.
b. have proven to be less traumatic to the hard structures, cementum, and supporting structures of the teeth.
c. are double-ended and because of their shape and size fit into the gingival sulcus easier.
d. are made of special metals that allow the detection of subgingival calculus that heavier instruments miss.

45. (630) In which instrument grasp, used to manipulate dental instruments, is the thumb left free to be used as a fulcrum for exceptional force?

a. Pen grasp.	c. Modified pen grasp.
b. Palm grasp.	d. Finger rest.

46. (631) An effective systematization of the periodontal scaling procedure is to scale

a. by quadrants.
b. freely since time is short.
c. only one quadrant.
d. only those teeth that are heavily scaled.

47. (632) To prevent your hand and arm from becoming fatigued during a tooth scaling procedure, you should

a. stand while working.
b. assume the position where the working area is higher than your heart.
c. sit while working.
d. assume the position where the working area is lower than your heart.

48. (633) Which of the following actions should you take if you pick up the wrong instrument during the scaling procedure?

a. Wipe it and replace it in the instrument cabinet.
b. Explain to the patient that you made a mistake.
c. Wash it and put it in the sterilizer.
d. Briefly use the instrument.

49. (634) The most difficult areas for locating and removing calculus deposits are the

a. concave grooves leading into the furcation areas of multirooted teeth.
b. lingual surfaces of the teeth.
c. subgingival areas of posterior teeth.
d. tooth areas in the immediate proximity of the salivary gland ducts.

50. (635) Which strokes are alterations allowed in the basic strokes of scaling so that you can scale all tooth surfaces?

a. Oblique or diagonal.	c. Diagonal or horizontal.
b. Vertical or oblique.	d. Horizontal or vertical.

51. (636) Gross deposits of stain are *best* removed by using

a. hand instruments.
b. coarse pumice.
c. 3-percent hydrogen peroxide.
d. a fine abrasive agent with a prophy brush.

52. (637) How long should patients avoid eating, drinking, or rinsing their mouth after a topical application of stannous flouride?

a. 10 minutes.	c. 30 minutes.
b. 15 minutes.	d. 60 minutes.

53. (638) What affect does heat have on alginate-type impression material?

a. Increases expansion.	c. Accelerates the set.
b. Decreases shrinkage.	d. Retards the set.

54. (639) Ideally, all the items used to make an alginate-type impression should be at what temperature?

a. 65° F to 72° F.
b. 75° F to 82° F.
c. 85° F to 92° F.
d. 95° F to 102° F.

55. (640) In the preparation of impression material, how is the powder and water combined?

a. Pour the water into the powder.
b. Pour the powder into the water.
c. Pour the water and the powder into the mixing bowl at the same time.
d. Any order of combination is acceptable.

56. (641) While you are fabricating the impression and inserting the rimlock tray, you should have the patient lean forward to

a. allow the material to set.
b. cover the surfaces of the teeth.
c. prevent material from running down the throat.
d. create a circular motion that is necessary for alignment purposes.

57. (642) While fabricating stone casts, air bubbles that have inadvertently formed while mixing are best removed by

a. jarring the bowl.
b. whipping the mix.
c. vibrating the tray after filling it.
d. trimming the excess stone from the tray.

58. (643) Which instrument is used in the construction of the working cast of a fabricated mouthguard to score the cast horizontally so that the mouthguard can later be trimmed?

a. Denture bur.
b. Denture brush.
c. Model trimmer.
d. Roach carver.

59. (644) What is oral flora?

a. Flowery growths on the tongue.
b. Flowery growths on the attached gingiva.
c. Abnormal bacteria found in the digestive tract.
d. Bacteria normally found in the mouth.

60. (645) Bacteria that derive their nourishment from dead or decaying matter are termed

a. saprophytes.
b. pathogens.
c. nonpathogens.
d. virulent pathogens.

61. (646) The most common of all the oral bacteria that is both Gram-positive and facultative is identified as

a. Staphylocci.
b. Streptococci.
c. Spirochetes.
d. Spirilla.

62. (647) What type of bacteria are prevalent with good oral hygiene?

a. Aerobic.
b. Anaerobic.
c. Facultative.
d. Cocci.

63. (648) In showing and explaining why good oral health care is needed, what can have the greatest impact on the patient?

a. Charts.
b. Graphs.
c. Literature.
d. Disclosing agent.

64. (649) How often must bacterial plaque be effectively removed to prevent dental disease?

a. Three times daily.
b. Twice each day.
c. At least once in every 24-hour period.
d. At least once every two to three days.

65. (650) Rinse vigorously with water after flossing to

a. remove food particles you have scraped loose.
b. remove bacterial plaque from the teeth.
c. stimulate the gum tissues.
d. dissolve any remaining disclosing agent.

66. (651) What is the *best* way to see if you have removed bacterial plaque?

a. You can see bacterial plaque on the teeth.
b. Floss once every 24 hours.
c. Brush thoroughly.
d. Use a disclosing agent.

67. (652) The chemical change that takes place in proteins during the digestive process is brought about by the reaction of the specific digestive enzyme called

a. lipase.
b. amylase.
c. polypeptidase.
d. protease.

68. (653) The part of the digestive process in which the end products of digestion pass through the lining of the digestive tract into the blood and lymphatic system is known as

a. synthesis.
b. absorption.
c. metabolism.
d. liquefaction.

69. (654) What is a standard unit for measuring heat which results from the body's energy expenditure?

a. Carbohydrate.
b. Calorie.
c. Protein.
d. Fat.

70. (654) Generally, what is the relationship, if any, between food intake and energy output in the average person?

a. Food intake should exceed energy output.
b. Energy output should exceed food intake.
c. Food intake should meet the energy output.
d. There is *no* general relationship between food intake and energy output.

71. (655) Name a protein substance which contains beneficial amounts of iron that is necessary in regulating body processes.

a. Urea.
b. Amino acid.
c. Hemoglobin.
d. Blood plasma.

72. (656) After amino acids have served their prescribed useful functions, the remaining part of the amino acid containing carbon, hydrogen, and oxygen may be converted to

a. tissue synthesis.
b. regulatory products.
c. urea through deamination.
d. either carbohydrate or body fat.

73. (657) As a precaution to assure that all essential amino acids are available in adequate amounts, menus should include sources of protein from

a. milk.
b. enriched grains.
c. both plants and animals.
d. both daily products and poultry.

74. (658) Which particular classification of carbohydrates remains in the intestine long enough to promote the bacterial growth necessary to form vitamin K and niacin during the digestive process?

a. Glucose.
b. Lactose.
c. Fructose.
d. Glycogen.

75. (659) Before they can be absorbed through the intestinal walls, double sugars must be

a. split into simple sugars.
b. combined with simple sugars.
c. replaced by complex sugars.
d. dissolved first in the stomach.

76. (660) In what part of the body is some glycogen stored at all times as a reserve sugar?

a. Lungs.
b. Liver.
c. Kidneys.
d. Gallbladder.

77. (661) An excess of carbohydrates in the form of concentrated sweets can

a. irritate the stomach and intestines.
b. reduce the need for proteins.
c. sharpen the appetite for other important foods.
d. prevent fermentation and gas formation.

78. (662) Which of the following food groups contains fatty acid with more than one missing hydrogen atom?

a. Saturated fatty foods.
b. Fats from animal sources.
c. Oleic acids found in various animal and plant sources.
d. Oils such as those extracted from corn, safflower, and soybeans.

79. (663) Fats are carriers of the following fat-soluble vitamins *except*

a. A.
b. B.
c. D.
d. E.

80. (664) Approximately what percent of the common fats are digested by the body?

a. 50 percent.
b. 75 percent.
c. 80 percent.
d. 95 percent.

81. (665) Within a few hours after absorption, what happens to fats?

a. They leave the blood and go into the body's tissues.
b. They leave the body's tissues and go into the blood.
c. They are burned by the body for energy.
d. They are stored as body fat to be used later as a source of energy.

82. (666) In an ideal diet, what percent of the total calorie intake should be fat?

a. 10 to 20 percent.
b. 20 to 40 percent.
c. 40 to 60 percent.
d. 60 to 80 percent.

83. (667) Calcium should be included in the diet because it functions mainly to

a. give bones and teeth hardness and strength.
b. eliminate the need for phosphorus in the diet.
c. eliminate the danger of the blood's thickening or clotting and causing heart failure.
d. soften bone structure and to make bones less brittle, and therefore less subject to being cracked.

84. (668) Acute calcium deficiency in children, involving lack of phosphorus and vitamin D would likely result in

a. rickets.
b. muscle twitches.
c. leg and foot cramps.
d. nervousness, irritability, and insomnia.

85. (669) What is the second most abundant mineral of the body?

a. Calcium.
b. Phosphorus.
c. Iron.
d. Potassium.

86. (670) What food is a dietary source of iron so rich that its use necessitates little dietary planning?

a. Poultry.
b. Liver.
c. Bread.
d. Spinach.

87. (671) What body condition best warns that the patient is suffering from iron-deficiency anemia?

a. Shortness of breath.
b. Iron-colored blood.
c. Blue-tinged, indicating inadequate oxygen.
d. Extreme tiredness and weakness, signifying that the body cells are *not* receiving adequate oxygen.

88. (672) The *most* noticeable symptom of an insufficient level of dietary iodine is observed by looking at the patient's

a. tongue.
b. eyes for a bloodshot condition.
c. skin color and temperature.
d. throat for swelling.

89. (673) The major function of sodium in the diet is to help

a. make food tasty.
b. maintain the body's water balance.
c. reduce heavy perspiration in hot weather.
d. eliminate the necessity of taking salt tablets.

90. (674) An important function of potassium in the diet is to

a. replace salt.
b. act in cell metabolism to balance cellular fluids.
c. combine with sodium chloride for elimination of sweating.
d. eliminate gout and goiter, and to ease the craving for water in hot climates.

91. (675) Which of the micronutrients combines with insulin for the storage of the hormone?

a. Cobalt.
b. Copper.
c. Magnesium.
d. Zinc.

92. (676) Including an adequate amount of vitamin A in the diet functions to

a. inhibit cell growth.
b. mend cavities in the teeth.
c. slow down mucous secretions of air-passage membranes.
d. promote normal vision and tooth structure.

93. (677) In addition to sunlight, which food source can *best* be relied upon to supply vitamin D in growing children?

a. Liver.
b. Egg yolk.
c. Fortified milk.
d. Potatoes.

94. (678) Which of the following vitamins helps prevent the deterioration caused by oxidation of certain foodstuffs?

a. A.
b. D.
c. E.
d. K.

95. (678) A good, reliable source of vitamin E includes which of the following foods or supplements in the diet?

a. Oils from certain seeds.
b. Light-leafed vegetables.
c. Meat and sweets.
d. Cod-liver oil.

96. (679) The lack of sufficient vitamin K in the diet would likely bring about

a. an enlarged liver.
b. the inability to digest mineral oil.
c. an increase in bacterial action within the intestines.
d. an increase in the tendency to hemorrhage and an increase in clotting time.

97. (680) A deficient supply of which of the following vitamins can cause the gums to become tender and bleed easily, joints to swell and become painful, and muscles to weaken?

a. C.
b. D.
c. E.
d. K.

98. (681) Which of the following vitamins is known as the ''morale'' vitamin because it is associated with the proper functioning of the nervous system in preventing irritability and depression?

a. Ascorbic acid.
b. Niacin.
c. Riboflavin.
d. Thiamine.

99. (682) A deficiency of which of the following vitamins can cause skin changes such as cracks at the corners of the mouth, inflammation of the lips and tongue and scaliness around the nose and ears?

a. Thiamine.
b. Niacin.
c. Riboflavin.
d. Folacin.

100. (683) A deficiency of which vitamin causes none of the enzyme systems involved with carbonhydrate metabolism to function properly?

a. Niacin.
b. Folacin.
c. Thiamine.
d. Riboflavin.

101. (684) Which of the following vitamins functions to aid enzymes in amino acid metabolism?

a. Folic acid.
b. Vitamin B_6.
c. Vitamin B_{12}.
d. Pantothenic acid.

102. (684) Which of the following vitamins is essential for the proper formation of red blood cells in the bone marrow?

a. Folic acid.
b. Vitamin B_6.
c. Vitamin B_{12}.
d. Pantothenic acid.

103. (685) An important lubricant in the body that prevents friction between moving body parts is

a. blood.
b. lymph.
c. gastric juices.
d. water.

104. (686) What is the normal recommended human intake of water per day?

a. 6 to 8 cups.
b. 6 to 8 quarts.
c. 12 to 16 cups.
d. 12 to 16 quarts.

105. (687) The chief reason that fiber, as a source of bulk, is included in the diet is to

a. absorb moisture.
b. harden the fecal mass.
c. stimulate peristaltic action.
d. solidify and dry the fecal mass.

106. (688) What is the daily recommendation of milk for persons under 20 years old?

a. 1 cup.
b. 1/2 pint.
c. 1 pint.
d. 1 quart.

107. (689) Two servings of foods in the meat group will furnish the average adult with

a. all of the iron needed daily.
b. one-half of the daily protein requirement.
c. twice the daily protein and iron requirements.
d. all of the daily protein and iron requirements.

108. (690) On what daily recurring basis should one serving of the vegetable-fruit group be made in planning an effective normal diet?

a. One per day.
b. Two per day.
c. Three per day.
d. Four or more per day.

109. (691) Bread-cereal products are an important source of food energy because they are very rich in

a. iron.
b. riboflavin.
c. protein.
d. carbohydrate.

110. (692) What is the major nutritional contribution made to the diet by those additional or "other" foods which supplement the four basic food groups?

a. Bulk.
b. Water.
c. Calories.
d. Minerals.

111. (693) Which of the following is the *most* important first aid procedure?

a. Never administer liquids by mouth to an unconscious patient.
b. Treat injuries in order of their importance.
c. Realize that it is best to defer any definitive treatment until you are sure of the primary problems.
d. Keep the patient lying down in a comfortable position, and the head level with the body until the seriousness of the condition is determined.

112. (694) Nitroglycerin tablets found in the emergency kit are used on patients

a. as a mild stimulant for syncope.
b. an an antiallergic drug.
c. with severe shock or acute reaction to drugs.
d. as a coronary dilator for angina pectoris.

113. (694) Which one of the following items located in the emergency kit is used as a vasopresser?

a. Ammonia carpules.
b. Benadryl.
c. Ephedrine sulfate.
d. Sobe-cortef.

114. (695) Where should sterile masks for the oxygen-inhalation equipment be stored?

a. In dental supply.
b. In the medical supply section.
c. In each dental treatment room.
d. In the oral surgery section only.

115. (695) The flowmeter should be adjusted to deliver how much oxygen to the patient?

a. 2 to 4 liters per minute.
b. 5 to 10 liters per minute.
c. 12 to 15 liters per hour.
d. 16 to 20 liters per hour.

116. (696) Systolic pressure is best described as the

a. highest pressure exerted on the circulatory system.
b. lowest pressure of the circulatory system.
c. normal adult respiration rate for a relaxed person.
d. heartbeat detected near the surface of the skin.

117. (696) Which of the following blood pressure readings is considered normal for an adult female?

a. 80/120.
b. 75/105.
c. 110/70.
d. 120/85.

118. (697) Which of the following types of shock is a temporary suspension of consciousness caused by cerebral anemia?

a. Syncope.
b. Neurogenic.
c. Anaphylactic.
d. Cardiogenic.

119. (697) What type of shock is a severe allergic response of the patient's body to a foreign protein substance in the blood?

a. Psychogenic.
b. Cardiogenic.
c. Anaphylactic.
d. Neurogenic.

120. (698) What is the first step of artificial ventilation?

a. Start mouth to mouth respiration.
b. Start mouth to nose respiration.
c. Insert an artificial airway device.
d. Restore the airway.

121. (698) What happens to a patient during cardiac arrest?

a. The heartbeat becomes weak and irregular.
b. The heart stops beating.
c. The patient has difficulty breathing.
d. The patient has a weak pulse.

122. (698) When performing two-rescuer CPR, what is the cardiac compression ventilation ratio?

a. 15 ventilations, 2 compressions.
b. 2 ventilations, 15 compressions.
c. 5 ventilations, 1 compression.
d. 1 ventilation, 5 compressions.

123. (699) The disease in which the patient is unable to metabolize sugar normally is

a. diabetic mellitus.
b. epilepsy.
c. hypoglycema.
d. angioneurotic edema.

124. (699) Which of the following emergency conditions is caused by accidental damage to the brain?

a. Cardiogenic shock.
b. Hypoglycema.
c. Epilepsy.
d. Cerebrovascular accident.

END OF EXERCISE

STUDENT REQUEST FOR ASSISTANCE

PRIVACY ACT STATEMENT

AUTHORITY: 10 USC 8012 and EO 9397. **PRINCIPAL PURPOSES:** To provide student assistance as requested by individual students. **ROUTINE USES:** This form is shipped with ECI course package. It is utilized by the student, as needed, to place an inquiry with ECI. **DISCLOSURE:** Voluntary. The information requested on this form is needed for expeditious handling of the student's need. Failure to provide all information would result in slower action or inability to provide assistance to the student.

SECTION I: CORRECTED OR LATEST ENROLLMENT DATA: *(Mail to: ECI, Gunter AFS AL 36118)*

1. THIS REQUEST CONCERNS COURSE (1 - 6)	2. TODAY'S DATE	3. ENROLLMENT DATE	4. AUTOVON NUMBER
5. SOCIAL SECURITY NUMBER (7 - 15) ☐☐☐ - ☐☐ - ☐☐☐☐	6. GRADE/RANK	7. NAME *(First initial, second initial, last name)* (17) (18) (19-32)	
8. ADDRESS *(OJT Enrollees -- Address of unit training office with zip code. All others -- current mailing address with zip code.)*	(33-53) (54-75)		
9. NAME OF BASE OR INSTALLATION IF NOT SHOWN ABOVE		10. TEST CONTROL OFFICE ZIP CODE/SHRED (33 - 39)	

SECTION II: REQUEST FOR MATERIALS, RECORDS, OR SERVICE

(Place an 'X' through number in box to left of service requested)

1	Request address change as indicated in Section I.
2	Request Test Control Office change as indicated in Section I.
3	Request name change/correction (Provide Old or Incorrect data)
4	Request Grade/Rank change/correction.
5	Correct SSAN. (List incorrect SSAN here) (Correct SSAN should be shown in Section I)
6	Extend course completion date. (Justify in REMARKS)
7	Request enrollment cancellation.
8	Send VRE answer sheets for Vol(s): 1 2 3 4 5 6 7 8 9 Originals were: ☐ Not received ☐ Lost ☐ Misused
9	Send course materials. (Specify in REMARKS) ☐ Not received ☐ Lost ☐ Damaged
10	Course exam not yet received. Final VRE submitted for grading on ______________ (date).
11	Results for VRE Vol(s) 1 2 3 4 5 6 7 8 9 not yet received. Answer sheet(s) submitted ______________ (date).
12	Results for CE not yet received. Answer sheet submitted to ECI on ______________ (date).
13	Previous inquiry (☐ ECI Fm 17, ☐ Ltr, ☐ Msg) sent to ECI on ______________ (date).
14	Give instructional assistance as requested on reverse.
15	Other (Explain fully in REMARKS)

FOR ECI USE ONLY

16		
G	33	
K	Vol 33 - 35	GR 36 - 38
M	33 - 34	35 - 40
N	33 - 38	
P	Vol 33 - 35	TC 36 - 37
Q	33 - 34 Q Q	Volume 35 - 37
38 1	39 - 42	
2	39 - 42	
3	39 - 42	
16		

REMARKS *(Continue on Reverse)*

OJT STUDENTS must have their OJT Administrator certify this request.	I certify that the information on this form is accurate and that this request cannot be answered at this station. *(Signature)*
ALL OTHER STUDENTS may certify their own requests.	

ECI FORM 17 OCT 82 (PREVIOUS EDITIONS MAY BE USED)

SECTION III: REQUEST FOR INSTRUCTOR ASSISTANCE

NOTE: Questions or comments relating to the accuracy or currency of subject matter should be forwarded directly to preparing agency. For an immediate response to these questions, call or write the course author directly, using the AUTOVON number or address in the preface of each volume. All other inquiries concerning the course should be forwarded to ECI.

VRE Item Questioned:

Course No ____________

Volume No ____________

VRE Form No ________

VRE Item No ________

Answer You Chose _______ (Letter)

Has VRE Answer Sheet been submitted for grading?

☐ Yes ☐ No

REFERENCE

(Textual reference for the answer I chose can be found as shown below)

In Volume No __________

On Page No ____________

In ☐ left ☐ right column

Lines ____ Through _____

MY QUESTION IS:

REMARKS

ADDITIONAL FORMS 17 available from trainers, OJT and Education Offices, and ECI. Course workbooks have a Form 17 printed on the last page.